TURBOCHARGER, G-CHARGER

CHARGE AIR SYSTEM WITH TURBOCHARGER

NOTE:

- **All hose connections are secured with clamps.**
- **Charge air system must be free of leaks.**
- **Always replace self-locking nuts.**
- **Charge air pressure hose and all the respective connections must be free of grease etc. before installing.**
- **Assembly tool VAS 5024 or hose clip pliers VAG 1921 are recommended for installing spring-type clips.**

Removing and installing turbocharger with attachments. See **TURBOCHARGER WITH ATTACHMENTS, REMOVING AND INSTALLING** .

Removing and installing parts of charge air cooler. See **CHARGE AIR COOLING COMPONENTS, REMOVING AND INSTALLING** .

Observe rules of cleanliness. See **RULES OF CLEANLINESS** .

Observe safety precautions. See **SAFETY PRECAUTIONS** .

Checking charge air pressure system. See **CHARGE AIR PRESSURE SYSTEM, CHECKING** .

Turbocharger with attachments, removing and installing (Part I)

NOTE: The following list refers to items in Fig. 1 .

1. **40 N.m**
   - Coat threads with G 052 112 A3
2. **Seal**
   - Always replace
3. **10 N.m**
   - Must not be loosened
4. **Pressure unit**
   - For charge pressure regulator valve in turbocharger
   - Checking charge pressure regulation. See **CHARGE AIR PRESSURE SYSTEM, CHECKING**
   - Can only be replaced in conjunction with turbocharger

5. **Circlip**
6. **Turbocharger**
    - Checking charge air pressure control. See **CHARGE AIR PRESSURE SYSTEM, CHECKING**
    - Charge air pressure control valve and charge air pressure control valve vacuum unit are components of the turbocharger and cannot be replaced individually
    - Fill turbocharger with oil via connection before connecting oil supply pipe
    - After installing turbocharger run engine at idling speed for approx. 1 minute and do not rev up, to ensure oil supply for turbocharger.
7. **O-ring**
    - Always replace
8. **10 N.m**
9. **Intake pipe**
10. **Gasket**
    - Always replace
    - Note installation position
11. **20 N.m**
12. **Heat shield**
13. **10 N.m**
14. **Banjo bolt, 30 N.m**
15. **Oil supply pipe**
16. **30 N.m**
    - Always replace
    - Coat threads and bolt head seating surface with G 052 112 A3
17. **Exhaust manifold**
18. **Gasket**
    - Always replace
    - Note installation position
19. **20 N.m**
20. **Banjo bolt, 30 N.m**
21. **25 N.m**
    - Always replace
    - Coat threads with G 052 112 A3
22. **Banjo bolt, 35 N.m**
23. **Coolant return pipe**
24. **25 N.m**
25. **Spacer sleeve**
26. **Banjo bolt, 35 N.m**
27. **10 N.m**

28. **Coolant supply pipe**
29. **Banjo bolt, 35 N.m**
30. **30 N.m**
    - Only use genuine bolt from parts catalog
31. **Support bracket**
    - Between turbocharger and cylinder block
32. **25 N.m**
33. **Gasket**
    - Always replace
34. **Gasket**
    - Always replace
35. **10 N.m**
36. **Oil return pipe**
    - To oil pan
37. **10 N.m**
38. **10 N.m**
    - Do not alter setting
    - Must not be loosened

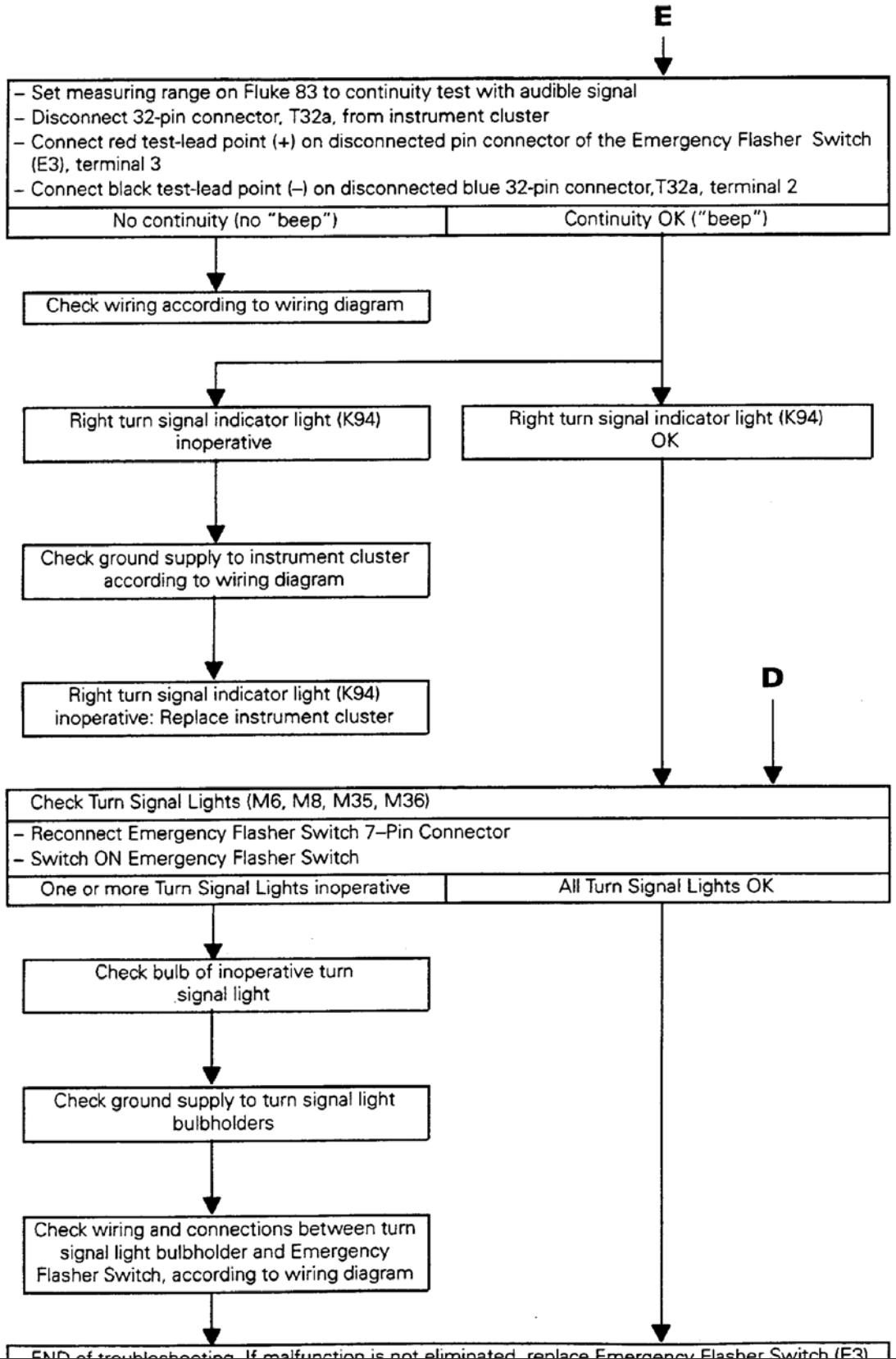

E
– Set measuring range on Fluke 83 to continuity test with audible signal
– Disconnect 32-pin connector, T32a, from instrument cluster
– Connect red test-lead point (+) on disconnected pin connector of the Emergency Flasher Switch (E3), terminal 3
– Connect black test-lead point (–) on disconnected blue 32-pin connector,T32a, terminal 2
No continuity (no "beep")
Continuity OK ("beep")
Check wiring according to wiring diagram
Right turn signal indicator light (K94) inoperative
Right turn signal indicator light (K94) OK
Check ground supply to instrument cluster according to wiring diagram
Right turn signal indicator light (K94) inoperative: Replace instrument cluster
D
Check Turn Signal Lights (M6, M8, M35, M36)
– Reconnect Emergency Flasher Switch 7–Pin Connector
– Switch ON Emergency Flasher Switch
One or more Turn Signal Lights inoperative
All Turn Signal Lights OK
Check bulb of inoperative turn signal light
Check ground supply to turn signal light bulbholders
Check wiring and connections between turn signal light bulbholder and Emergency Flasher Switch, according to wiring diagram

Fig. 1: Removing And Installing Turbocharger With Attachments - Part I
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Turbocharger with attachments, removing and installing Part II

NOTE:

- **Components marked with an * are checked by the On Board Diagnostic (OBD).**

  See On Board Diagnostic (OBD) .

- **Components marked with ** are checked by the Output Diagnostic Test Mode (DTM).**

  See Output Diagnostic Test Mode (DTM) .

- **Observe installed position of heat protection mats**

Only for engine code APH

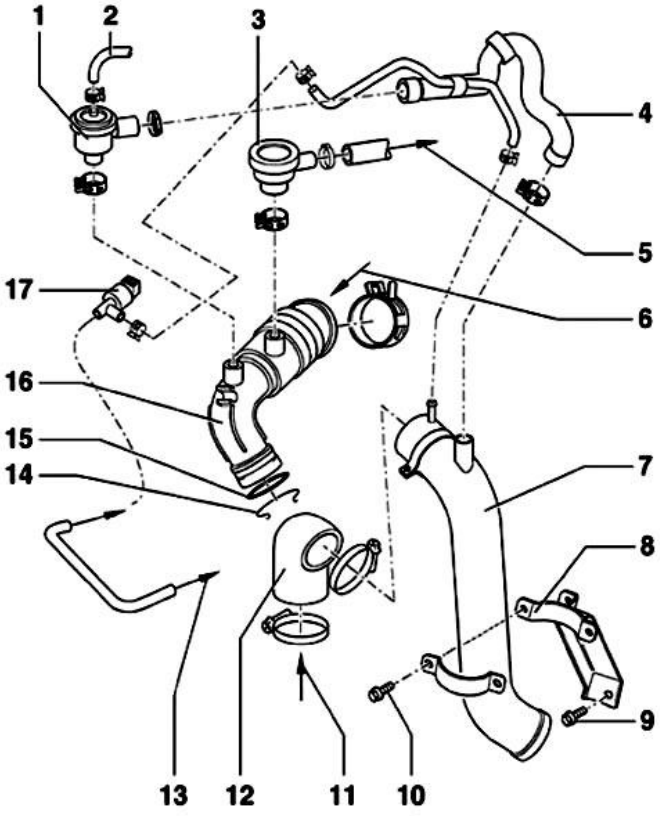
Engine codes AWP, AWV. See **ENGINE CODES AWP, AWV** .

NOTE: The following list refers to items in Fig. 2 .

1. **Charge pressure bypass valve**
   - Checking charge air pressure regulation. See **CHARGE AIR PRESSURE SYSTEM, CHECKING**
2. **Connecting pipe/hose**
   - Recirculating valve for turbocharger - N249-*/**. See 16
3. **Pressure regulator valve**
   - For crankcase ventilation
4. **Connecting pipe/hose**
   - From charge pressure bypass valve to upper air duct
5. **To crankcase ventilation**
6. **From air filter**
7. **Upper air guiding duct**
   - Vehicles with engine code APH, with screw clamp
8. **Bracket**
9. **25 N.m**
10. **10 N.m**
11. **From exhaust turbocharger-exhaust connection**
12. **Connecting pipe/hose**

13. **Connecting pipe/hose**
    - To vacuum diaphragm for Wastegate Bypass Regulator Valve -N75-
14. **Circlip**
15. **O-ring**
    - Always replace
16. **Intake hose**
    - To intake connection of exhaust turbocharger
17. **Wastegate Bypass Regulator Valve -N75-**
    - The valve will be activated from engine control module (pulsed)
        - Check activation with output Diagnostic Test Mode (DTM).

    See Output Diagnostic Test Mode (DTM)



1 - Charge pressure bypass valve
2 - Connecting pipe/hose
3 - Pressure regulator valve
4 - Connecting pipe/hose
5 - To crankcase ventilation
6 - From air filter
7 - Upper air guiding duct
8 - Bracket
9 - 25 Nm
10 - 10 Nm
11 - From exhaust turbocharger-exhaust connection
12 - Connecting pipe/hose
13 - Connecting pipe/hose
14 - Circlip
15 - O-ring
16 - Intake hose
17 - Wastegate Bypass Regulator Valve -N75-

G03257745

Fig. 2: Removing And Installing Turbocharger With Attachments - Part II
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Engine codes AWP, AWV

NOTE: The following list refers to items in Fig. 3 .

1. **Pressure regulator valve**
   - For crankcase ventilation
2. **To crankcase ventilation**
3. **Charge pressure bypass valve**
   - Checking charge air pressure regulation. See **CHARGE AIR PRESSURE SYSTEM, CHECKING**
4. **Connecting pipe/hose**
   - To recirculating valve for turbocharger (N249)*/**. See 16
5. **Connecting pipe/hose**
   - From charge pressure bypass valve to upper air duct
6. **From air filter**
7. **Upper air guiding duct**
   - Observe installed position of heat protection mat
   - Vehicles with Engine Code AWP, AWV; with quick release connection (with O-ring and securing brace)
8. **Bracket**
9. **40 N.m**
10. **25 N.m**
11. **For connecting hose of connecting piece/charge air cooler at bottom**
12. **O-ring**
    - Replace
13. **Circlip**
    - Replace
14. **10 N.m**
15. **From exhaust turbocharger-exhaust connection**
16. **Connecting pipe/hose**
17. **Connecting pipe/hose**
    - To vacuum diaphragm for Wastegate Bypass Regulator Valve -N75-
18. **Circlip**
    - Check seated securely
19. **O-ring**
    - Replace
20. **Intake hose**
    - To intake connection of exhaust turbocharger
21. **Connecting pipe/hose**
    - To vacuum booster.

- Check Turbocharging diagram. See **ENGINE CODES AWP, AWV**

22. **Wastegate Bypass Regulator Valve (N75)*/****
    - The valve will be activated from engine control module (pulsed)
    - Check activation with Output Diagnostic Test Mode (DTM).

      See Output Diagnostic Test Mode (DTM)

Fig. 3: Removing And Installing Turbocharger With Attachments - Engine Codes AWP, AWV
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Charge air cooling components, removing and installing

NOTE:

- **All hose connections secured by clamps.**
- **Charge air system must be free of leaks.**
- **When installing observe markings on hoses and components.**
- **Observe installed position of heat protection mats**

NOTE: The following list refers to items in Fig. 4 .

1. **Air ducting**
   - Clip in at charge air cooler
2. **10 N.m**
3. **Charge Air Pressure Sensor -G31-**
   - Checking charge pressure control. See **CHARGE AIR PRESSURE SYSTEM, CHECKING**
4. **O-ring**
   - Always replace
5. **Rubber grommet**
   - With sleeve
6. **10 N.m**
7. **Intake hose**
   - Between intake manifold and charge air cooler
8. **Heat protection mat**
   - Must enclose upper hose clamp
9. **Screw-type clip**
   - Only vehicles with engine code APH
   - Vehicles with engine codes AWP, AWV, with quick release connection (with O-ring and securing brace)
10. **Connecting pipe/hose**
    - Between upper and lower air guiding ducts
11. **Air duct**
12. **Bracket**
13. **Connecting pipe/hose**
14. **Charge air cooler**
    - Installation location: in front of wheelhousing, right front

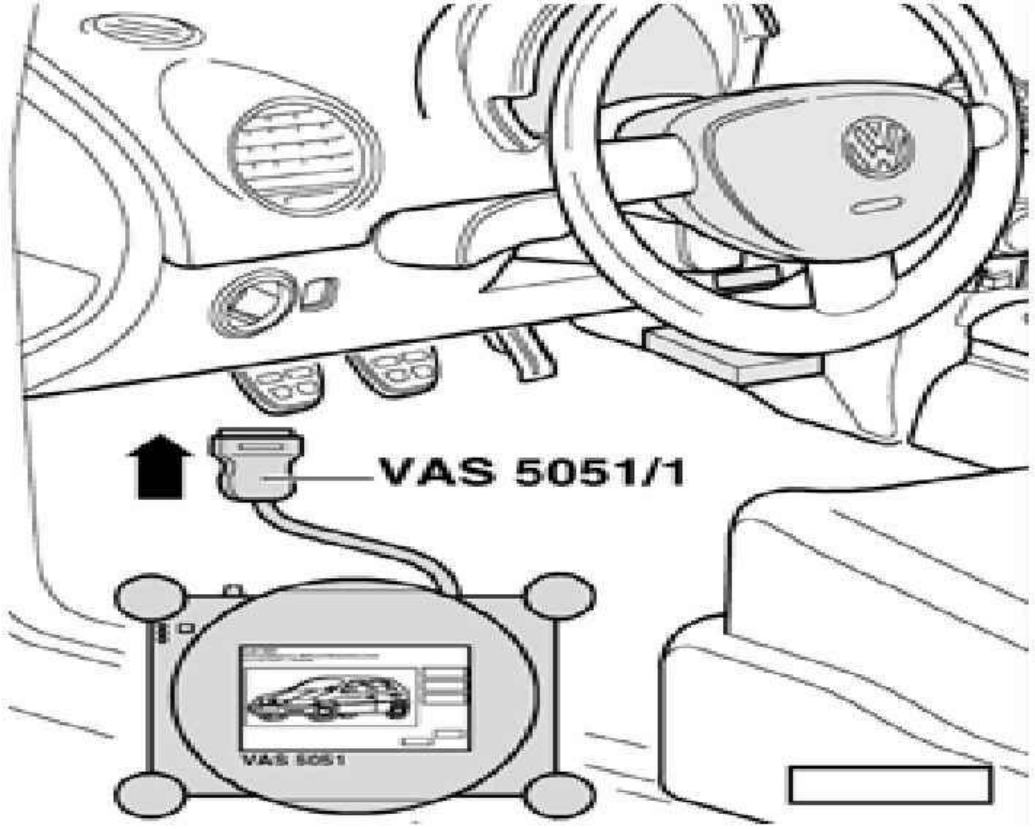


Fig. 4: Removing And Installing Charge Air Cooling Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Turbocharging diagram

Only engine code APH

Engine codes AWP, AWV. See **ENGINE CODES AWP, AWV**

NOTE: The following list refers to items in Fig. 5 .

1. **Connecting pipe/hose**
   - From gravity valve on fuel tank. See **EVAPORATIVE EMISSION (EVAP) SYSTEM COMPONENTS, SERVICING** , Item 1
2. **Vacuum reservoir**

- Below rear right wheelhousing

3. **Non-return valve**
   - For Evaporative Emission (EVAP) system
   - Observe installation position: arrows point in direction of flow
4. **Turbocharger**
5. **Pressure unit**
   - For charge pressure regulator valve in turbocharger
6. **Charge pressure bypass valve**
   - Checking charge pressure control. See **CHARGE AIR PRESSURE SYSTEM, CHECKING**
7. **Wastegate Bypass Regulator Valve -N75-*/****
   - The valve will be activated from engine control module (pulsed)
   - Checking activation with output Diagnostic Test Mode (DTM)

     See Output Diagnostic Test Mode (DTM)

8. **Brake servo**
9. **Air cleaner with Mass Air Flow (MAF) sensor -G70-**
10. **Crankcase breather pressure regulating valve**
11. **Vacuum booster**
12. **Fuel pressure regulator**
13. **Crankcase breather**
14. **Intake pipe**
15. **Non-return valve**
    - Observe installation position: arrows point in direction of flow
16. **Recirculating valve for turbocharger -N249-*/****
    - Checking. See **RECIRCULATING VALVE FOR TURBOCHARGER -N249-, CHECKING**
    - Output Diagnostic Test Mode (DTM)

      See Output Diagnostic Test Mode (DTM)

17. **Vacuum reservoir**
    - Bolted onto cylinder head cover
18. **Secondary air injection (AIR) solenoid valve -N112-*/****
    - Checking. See **SECONDARY AIR INJECTION (AIR) SOLENOID VALVE -N112-, CHECKING**
    - Output Diagnostic Test Mode (DTM)

      See Output Diagnostic Test Mode (DTM)

19. **Charge air cooler**

20. **EVAP canister purge regulator valve -N80-*/****
    - On right side of engine compartment above wheelhousing liner
    - Checking. See **EVAP CANISTER PURGE REGULATOR VALVE -N80-, CHECKING**
    - Output Diagnostic Test Mode (DTM)

      See Output Diagnostic Test Mode (DTM)

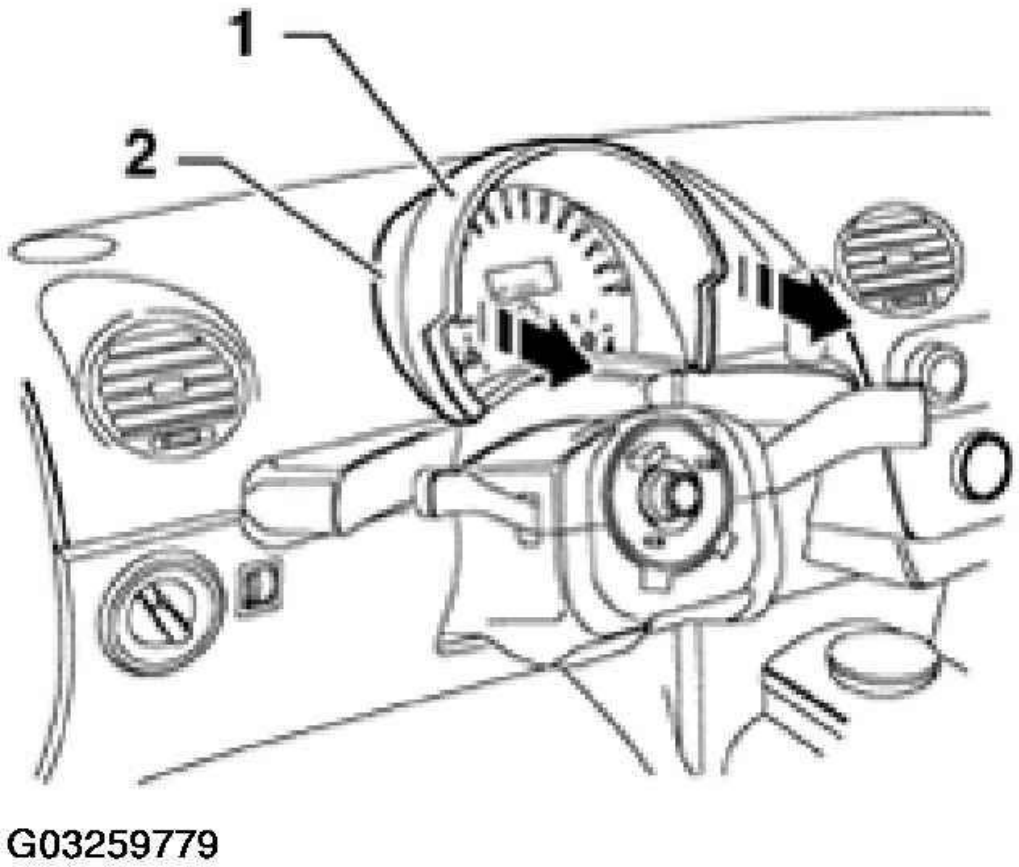


Fig. 5: Turbocharging Diagram - Engine Code APH
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Engine codes AWP, AWV

NOTE: The following list refers to items in Fig. 6 .

1. **Connecting pipe/hose**

- From Leak detection pump (LDP) -V144-

2. **Vacuum reservoir**
   - Under right rear wheel well liner
3. **Non-return valve**
   - Observe installation position: arrows point in direction of flow
4. **Turbocharger**
5. **Pressure unit**
   - For charge air pressure control valve
6. **Crankcase breather pressure regulating valve**
7. **Wastegate Bypass Regulator Valve -N75-*/****
   - The valve will be activated from engine control module (pulsed)
   - Checking activation:

     See Output Diagnostic Test Mode (DTM)

8. **Brake servo**
9. **Combi-valve**
   - For secondary air system
   - Checking. See **COMBI-VALVE, CHECKING**
10. **Air cleaner with Mass Air Flow (MAF) sensor -G70-**
11. **Non-return valve**
    - Observe installation position.
12. **Charge pressure bypass valve**
    - Checking charge pressure control. See **CHARGE AIR PRESSURE SYSTEM, CHECKING**
13. Secondary air injection pump motor -V101-
    - Checking function. See **SECONDARY AIR INJECTION (AIR) PUMP MOTOR -V101-, CHECKING**
14. **Vacuum booster**
15. **Crankcase breather**
16. **Fuel pressure regulator**
17. **Intake pipe**
18. **Recirculating valve for turbocharger -N249-**
19. **Vacuum reservoir**
20. **Secondary air injection (AIR) solenoid valve -N112-**
    - Checking. See **SECONDARY AIR INJECTION (AIR) SOLENOID VALVE -N112-, CHECKING**
21. **Charge air pressure sensor -G31-**
    - Replace O-ring if damaged

22. **Charge air cooler**
23. **Evaporative emission (EVAP) canister purge regulator valve -N80-**
    - Checking activation:

      See Output Diagnostic Test Mode (DTM)

    - Checking function. See **EVAP CANISTER PURGE REGULATOR VALVE -N80-, CHECKING**
24. **Connecting hose**
    - To EVAP canister

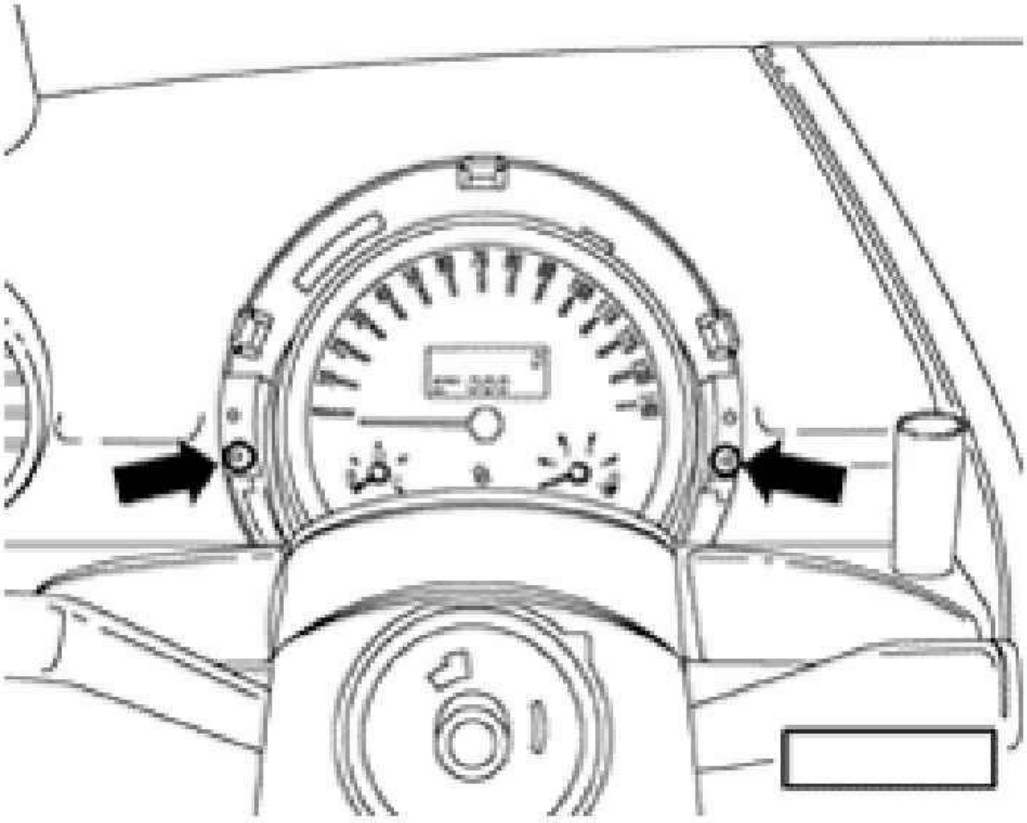


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Fig. 6: Turbocharging Diagram - Engine Code AWP, AWV
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Rules of cleanliness

When working on the exhaust gas turbocharger, pay careful attention to the following 5 rules:

- Thoroughly clean all unions and the adjacent areas before disconnecting.
- Place parts that have been removed on a clean surface and cover. Do not use fluffy cloths!
- Carefully cover opened components or seal if the repair cannot be carried out immediately.
- Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored loose (e.g. in tool boxes etc.).
- When the system is open: Do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.

Safety precautions

WARNING: When doing any repair work, especially in the engine compartment, due to the cramped conditions, pay attention to the following:

- **Route all sorts of lines/hoses (e.g. for fuel, hydraulics, evaporative emissions system, coolant, refrigerant, brake fluid and vacuum lines and hoses) and electrical wiring so that the original positions are restored.**
- **Make sure sufficient clearance to all moving or hot components.**

Observe the following if test and measuring instruments are required during a test drive:

- Test and measuring instruments must be secured to rear seat and operated by a 2nd person from this location.
- If test and measuring instruments are operated from front passenger's seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat may receive serious injuries when the airbag is triggered.

CHARGE AIR PRESSURE SYSTEM, CHECKING

Charge air pressure regulation, checking (APH)

Engine codes AWP, AWV. See **Charge air pressure regulation, checking (AWP, AWV)** .

Special tools and equipment

- VAG 1397 A Turbocharger tester

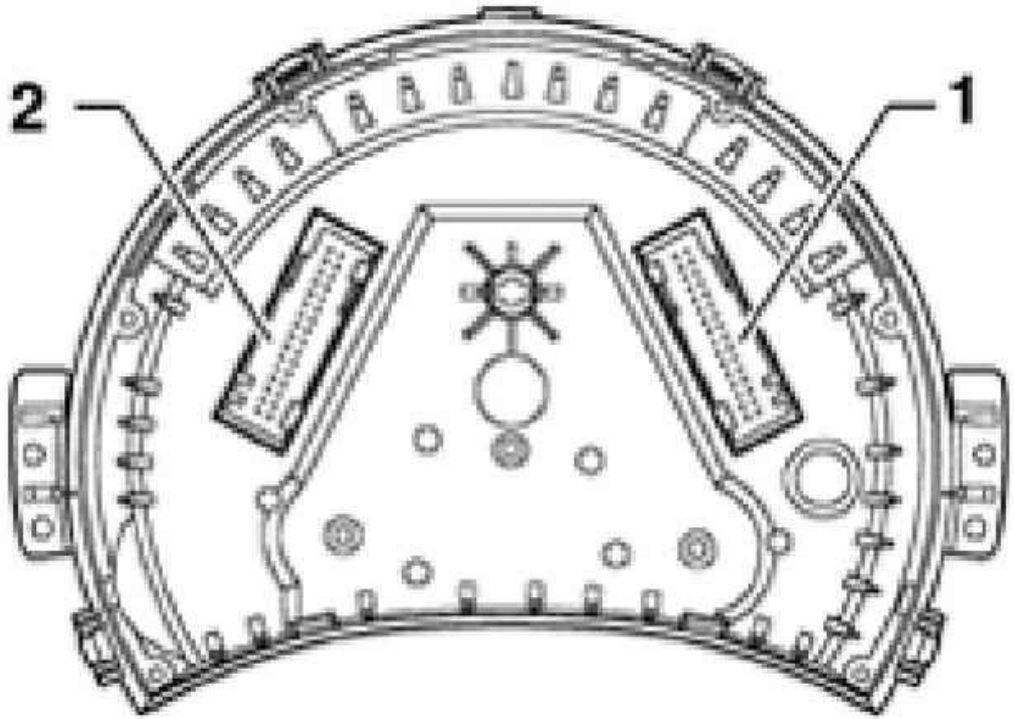

Fig. 7: Identifying VAG 1397 A Turbocharger Tester
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Check conditions

- No leaks on intake and exhaust systems
- Engine oil temperature min. 60° C

Test sequence

Measure the charge pressure under full load, while driving or on a rolling road. Test duration per measurement max. 10 seconds.

- Pull off connecting hose running between intake manifold and fuel pressure regulator at intake manifold and connect in turbocharger tester VAG 1397 A using T-piece.

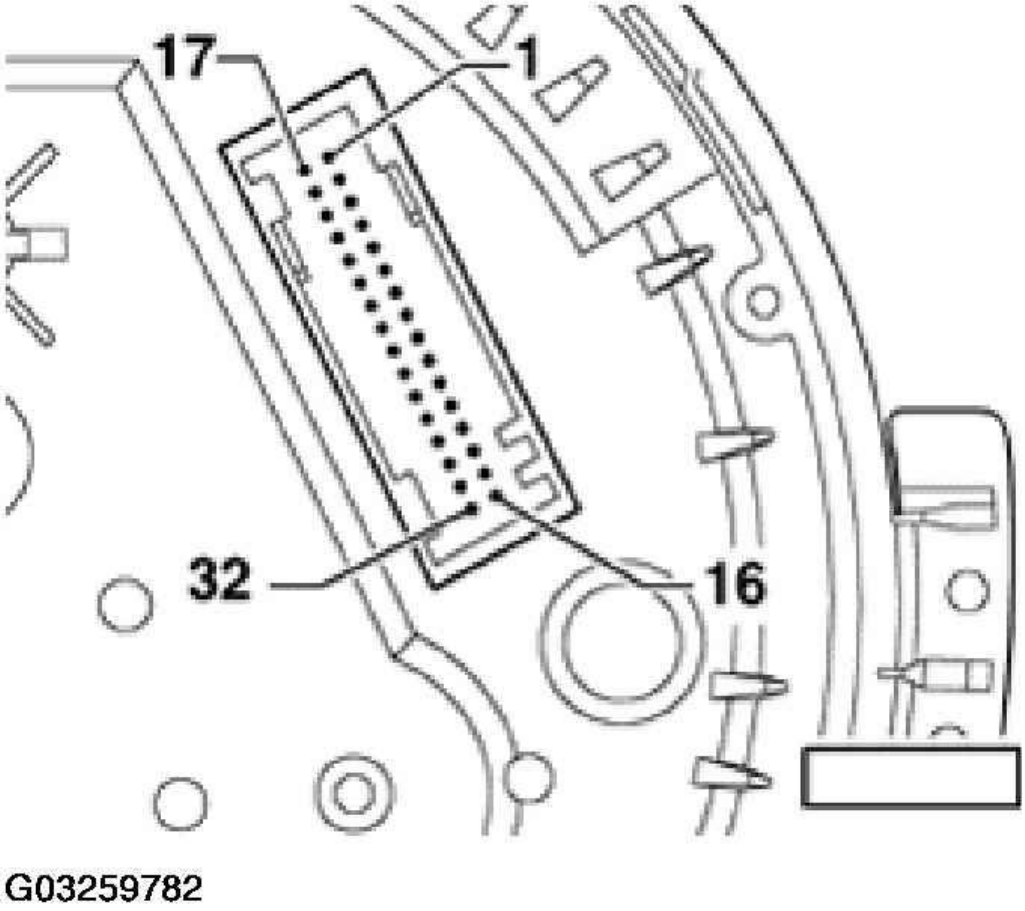

Fig. 8: Connecting In Turbocharger Tester VAG 1397 A Using T-Piece
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Select measuring range -I-.

NOTE:

- **Operating turbocharger tester. See operating instructions.**
- **The hoses must be connected so that there is no possibility of leaks.**
- **If charge pressure is measured while driving, it is necessary (for safety reasons) for a second person to operate the turbocharger tester.**
- **Ensure that the pressure hose is not trapped between the hood and the body.**

Measuring charge pressure at wide open throttle:

- Accelerate with wide open throttle from 2000 RPM in 3rd gear or in 2nd driving range.
- At 3000 RPM press memory button "M" on turbocharger tester.

  Specification: (absolute pressure) 1.300-1.400 bar

If the charge pressure is exceeded:

- Disconnect connector -2- from Wastegate Bypass Regulator Valve -N75- -1-.

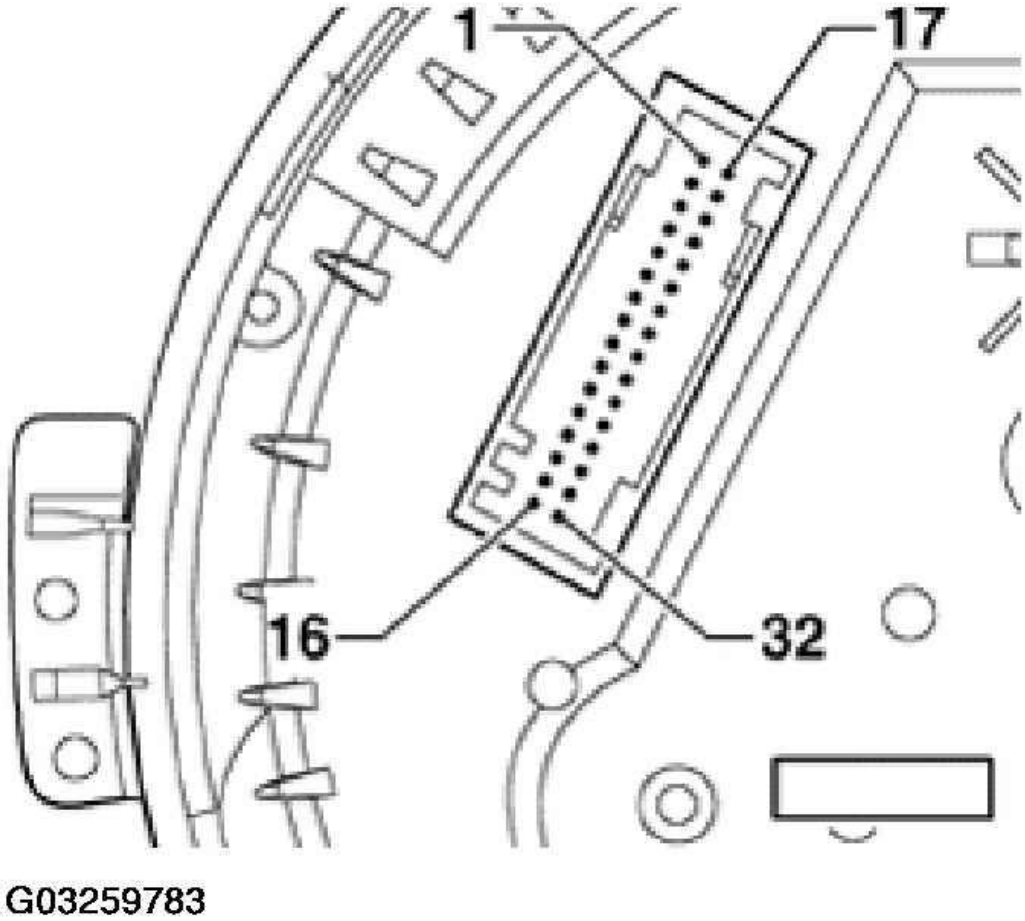

Fig. 9: Disconnecting Connector From Wastegate Bypass Regulator Valve -N75
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check hose from connecting pipe (between turbocharger and charge air cooler) via valve to vacuum diaphragm for clogging.

- Check that pressure unit for charge pressure regulator valve is securely mounted on turbocharger.
- Check shaft mount for regulator valve in turbocharger for ease of movement. When corroded together, replace turbocharger.

If the charge pressure is not attained:

- Check Wastegate Bypass Regulator Valve -N75-.

Charge air pressure regulation, checking (AWP, AWV)

Special tools and equipment

- VAG 1551 scan tool

NOTE: The vehicle system tester VAG 1552 can be used instead of the VAG 1551 scan tool, however a print-out is not possible.

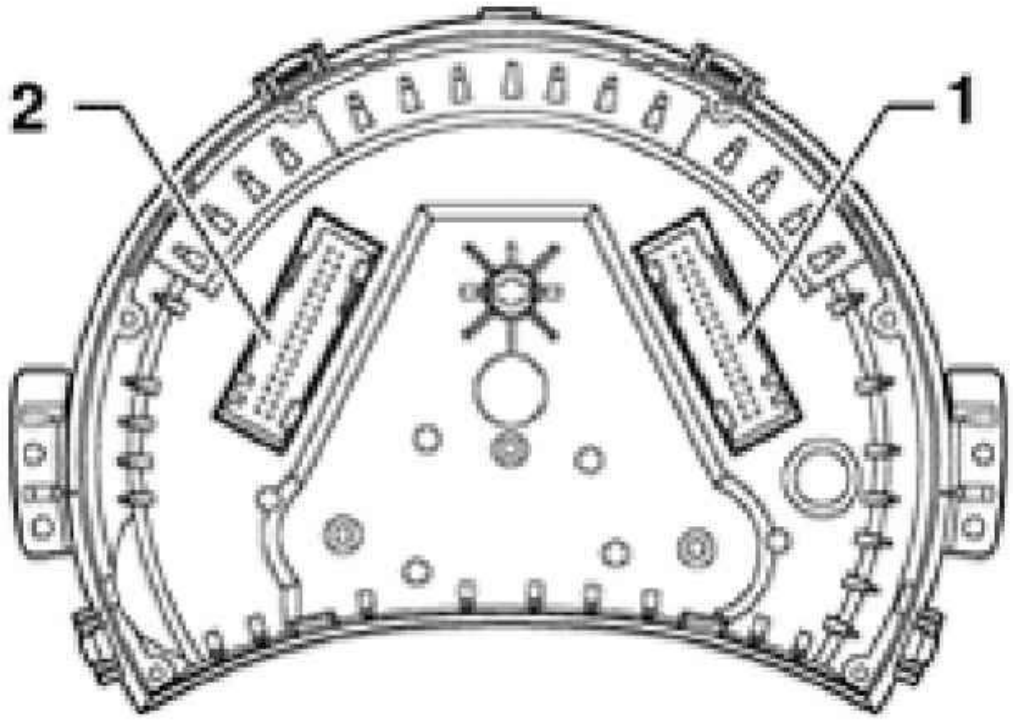

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Fig. 10: Identifying VAG 1551 Scan Tool
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- VAG 1551 /3B Cable

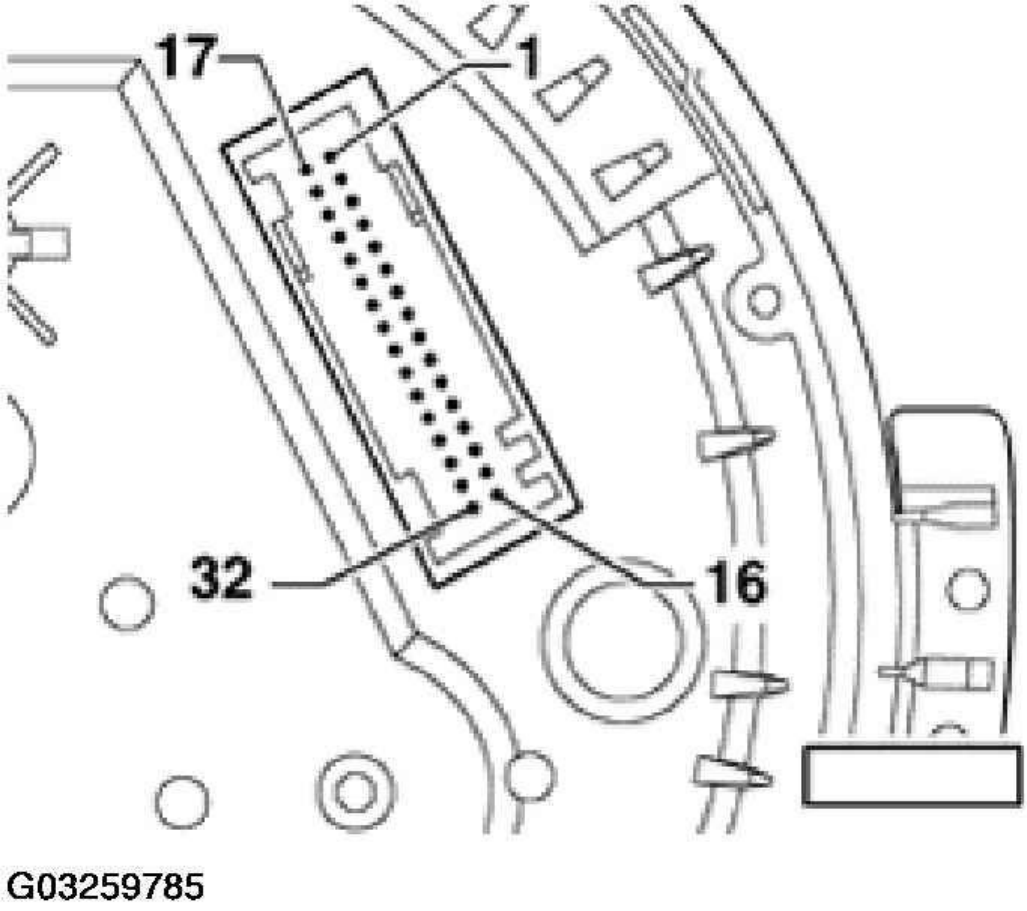

Fig. 11: Identifying VAG 1551 /3B Cable
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test conditions

- Check and erase DTC memory, if necessary:

  See Diagnostic Trouble Code (DTC) Memory, Checking And Erasing .

- No leaks on intake and exhaust systems

- Engine oil temperature min. 80° C

Test sequence

The charge air pressure is measured under full load, while driving or on a rolling road.

Observe applicable safety precautions when carrying out a road test. See **SAFETY PRECAUTIONS** .

- Connect VAG 1551 Scan Tool (VAG 1552). Start engine and select engine electronics control module with "Address word" 01. Connecting scan tool and selecting engine control module:

See V.A.G 1551 Scan Tool, Connecting And Selecting Engine Control Module

Indicated on display:

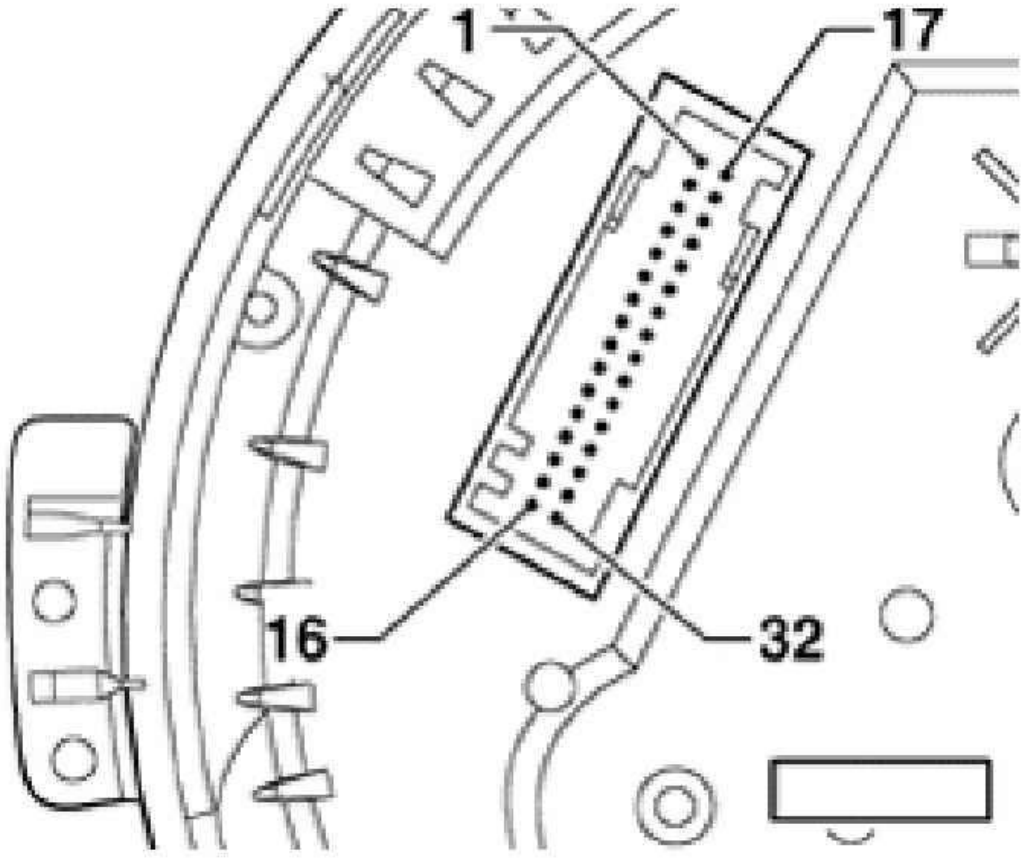

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Fig. 12: V.A.G 1551 Scan Tool Display - Checking Charge Air Pressure System (1 Of 4)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -8- for function "Read measured value block" and confirm entry with -Q- button.

Indicated on display:

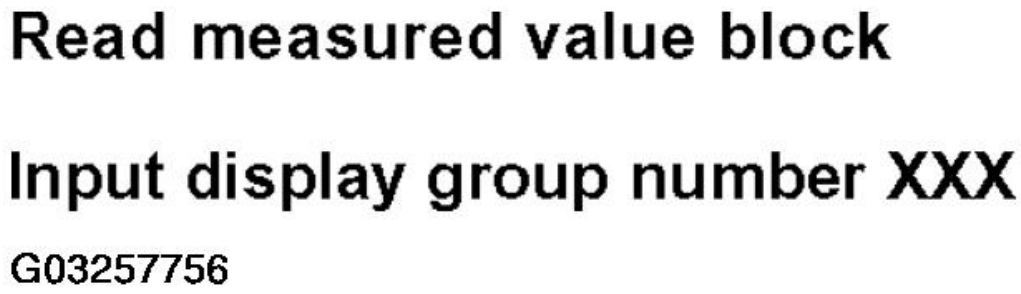


Fig. 13: V.A.G 1551 Scan Tool Display - Checking Charge Air Pressure System (2 Of 4)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -1-, -1- and -4- for "Display group number 114" and confirm entry with -Q- button.

Indicated display: (1 to 4 = Display zones)

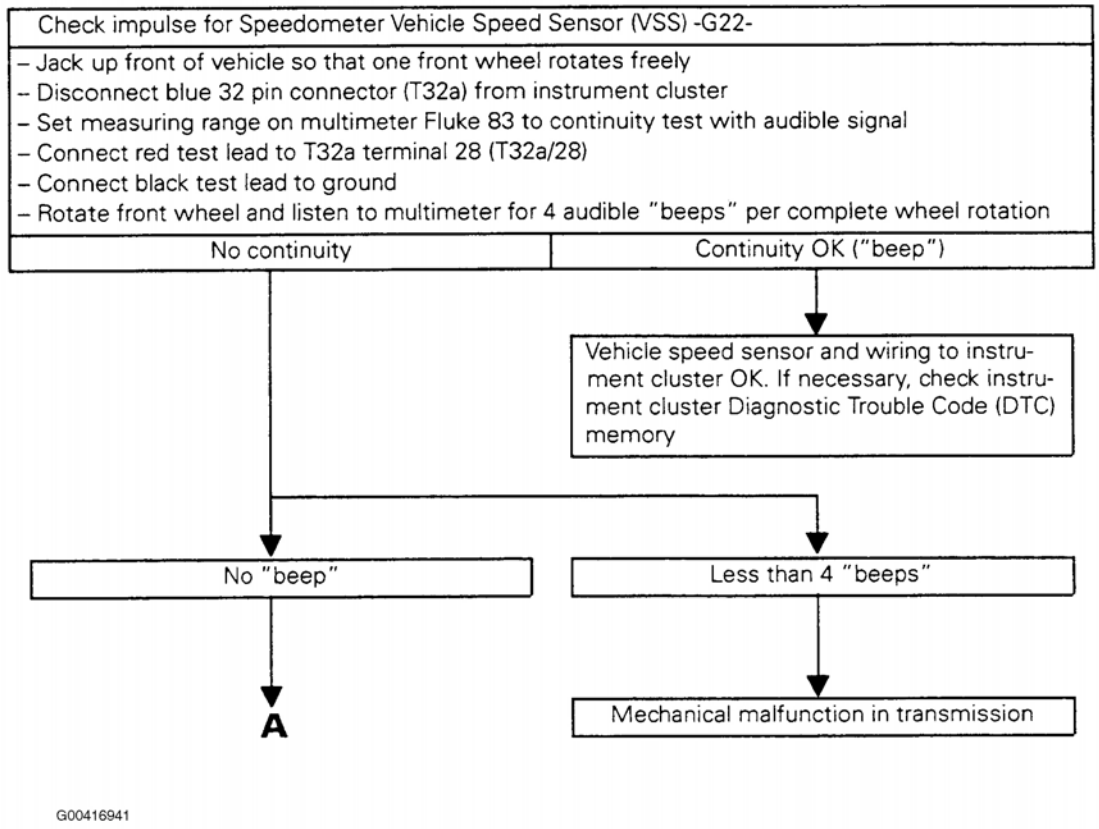

Check impulse for Speedometer Vehicle Speed Sensor (VSS) -G22-
– Jack up front of vehicle so that one front wheel rotates freely
– Disconnect blue 32 pin connector (T32a) from instrument cluster
– Set measuring range on multimeter Fluke 83 to continuity test with audible signal
– Connect red test lead to T32a terminal 28 (T32a/28)
– Connect black test lead to ground
– Rotate front wheel and listen to multimeter for 4 audible "beeps" per complete wheel rotation
No continuity
Continuity OK ("beep")
Vehicle speed sensor and wiring to instrument cluster OK. If necessary, check instrument cluster Diagnostic Trouble Code (DTC) memory
No "beep"
Less than 4 "beeps"
A
Mechanical malfunction in transmission
G00416941

Fig. 14: V.A.G 1551 Scan Tool Display - Checking Charge Air Pressure System (3 Of 4)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check duty cycle of Wastegate Bypass Regulator Valve (N75) in display zone 4 (at wide open throttle between 1800 to 2300 RPM) during a test drive or on a rolling road.

  Specification: 5.0...95.0%

If the specification is obtained:

- Change to display group 115 as follows:

  VAG 1551: press button 3

  VAG 1552: press button "UPARROW"

Indicated display: (1 to 4 = Display zones)

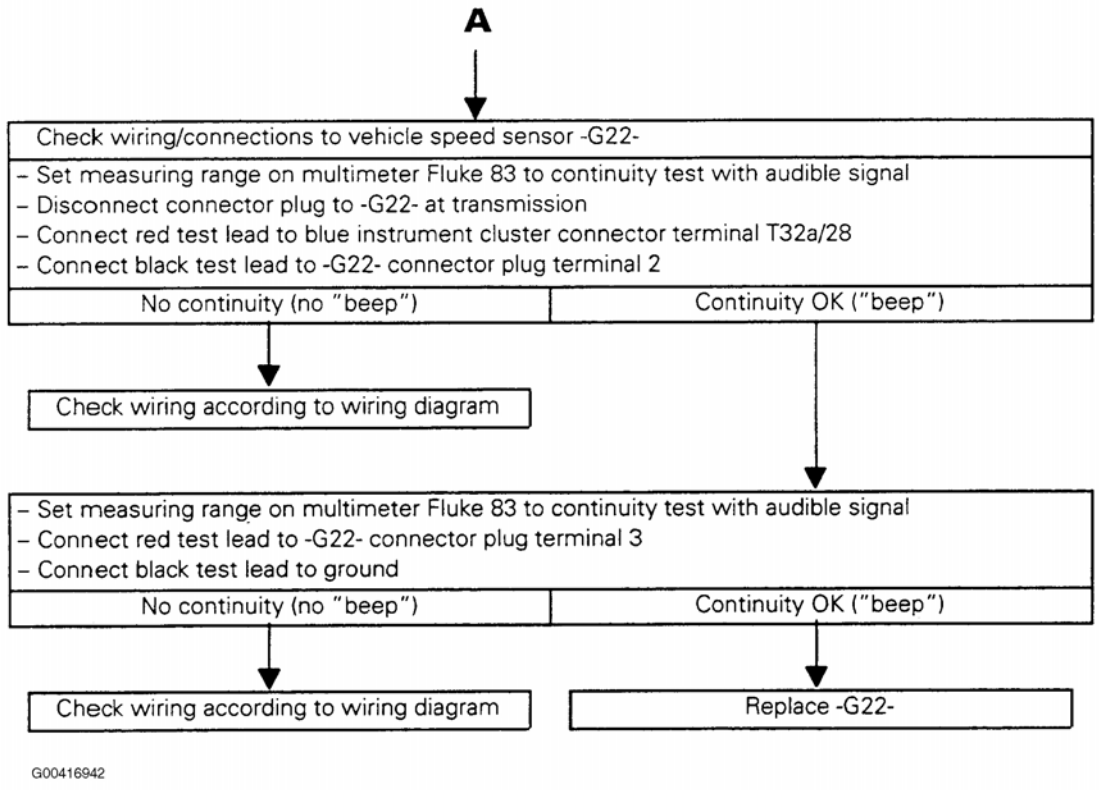

A
Check wiring/connections to vehicle speed sensor -G22-
– Set measuring range on multimeter Fluke 83 to continuity test with audible signal
– Disconnect connector plug to -G22- at transmission
– Connect red test lead to blue instrument cluster connector terminal T32a/28
– Connect black test lead to -G22- connector plug terminal 2
No continuity (no "beep")
Continuity OK ("beep")
Check wiring according to wiring diagram
– Set measuring range on multimeter Fluke 83 to continuity test with audible signal
– Connect red test lead to -G22- connector plug terminal 3
– Connect black test lead to ground
No continuity (no "beep")
Continuity OK ("beep")
Check wiring according to wiring diagram
Replace -G22-
G00416942

Fig. 15: V.A.G 1551 Scan Tool Display - Checking Charge Air Pressure System (4 Of 4)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check charge pressure (actual value) at wide open throttle in display zone 4:

On rolling road

In 3rd gear or in 2nd driving range

During test drive

Vehicles with manual transmission.

- Accelerate in 2nd gear with wide open throttle.

Vehicles with automatic transmission.

- Manually select drive mode 3 and accelerate vehicle from a low speed at Wide Open Throttle (WOT, without Kick-Down).

Engine code AWV

- Press print button between 1800 to 2300 RPM and read charge air pressure actual value in display zone 4.

Specification: 1350 to 1750 bar

Engine code AWP

- Press print button between 1800 to 2300 RPM and read charge air pressure actual value in display zone 4.

  Specification: 1700 to 2000 bar

Continued for all vehicles

- Compare actual charge air pressure value with specified charge air pressure value in display zone 3.

  Difference: max. 100 mbar

  NOTE: Repeat the measurement if the charge air pressure has not fully built-up or there is a large difference between specified and actual values.

- Press --> button.
- Press buttons -0- and -6- for "End output" function and confirm input with -Q- button.
- Switch ignition off.

If the charge air pressure is exceeded:

- Check Charge Air Pressure Sensor -G31-. See **CHARGE AIR PRESSURE SENSOR -G31-, CHECKING** .
- Check Wastegate Bypass Regulator Valve -N75-. (Hose from turbocharger via valve to pressure unit not blocked when connector is pulled off).
- Check pressure unit for charge air pressure regulating valve is securely mounted on turbocharger.
- Check pressure unit. See **PRESSURE UNIT FOR WASTEGATE BYPASS REGULATOR VALVE -N75-, CHECKING**
- Check shaft mount for charge air pressure regulating valve in turbocharger for ease of movement. When corroded together, replace turbocharger.

If the charge air pressure is not attained:

- Check Charge Air Pressure Sensor -G31-. See **CHARGE AIR PRESSURE SENSOR -G31-, CHECKING** .
- Check Wastegate Bypass Regulator Valve -N75-. See **WASTEGATE BYPASS REGULATOR VALVE -N75-, CHECKING** .
- Check shaft mount for charge air pressure regulating valve in turbocharger for ease of movement. When corroded together, replace turbocharger.
- Turbocharger malfunctioning. Replace turbocharger. See **TURBOCHARGER WITH ATTACHMENTS, REMOVING AND INSTALLING** .
- Check DTC memory:

See Diagnostic Trouble Code (DTC) Memory, Checking And Erasing .

- Read readiness code:

  See Readiness Code, Displaying .

If the DTC memory has been erased or the engine control module separated from the permanent positive, the readiness code must be generated again.

See Readiness Code, Displaying .

Wastegate Bypass Regulator Valve -N75-, checking

Special tools and equipment

- VAG 1551 scan tool or vehicle system tester VAG 1552 with cable VAG 1551 /3B
- VAG 1526 Hand multimeter or VAG 1715 multimeter
- Adapter set VAG 1594

Test conditions

- Output Diagnostic Test Mode (DTM) carried out

  See Output Diagnostic Test Mode (DTM) .

Test sequence

- Switch ignition off.
- Pull 2-pin connector off Wastegate Bypass Regulator Valve -N75- -arrow-.

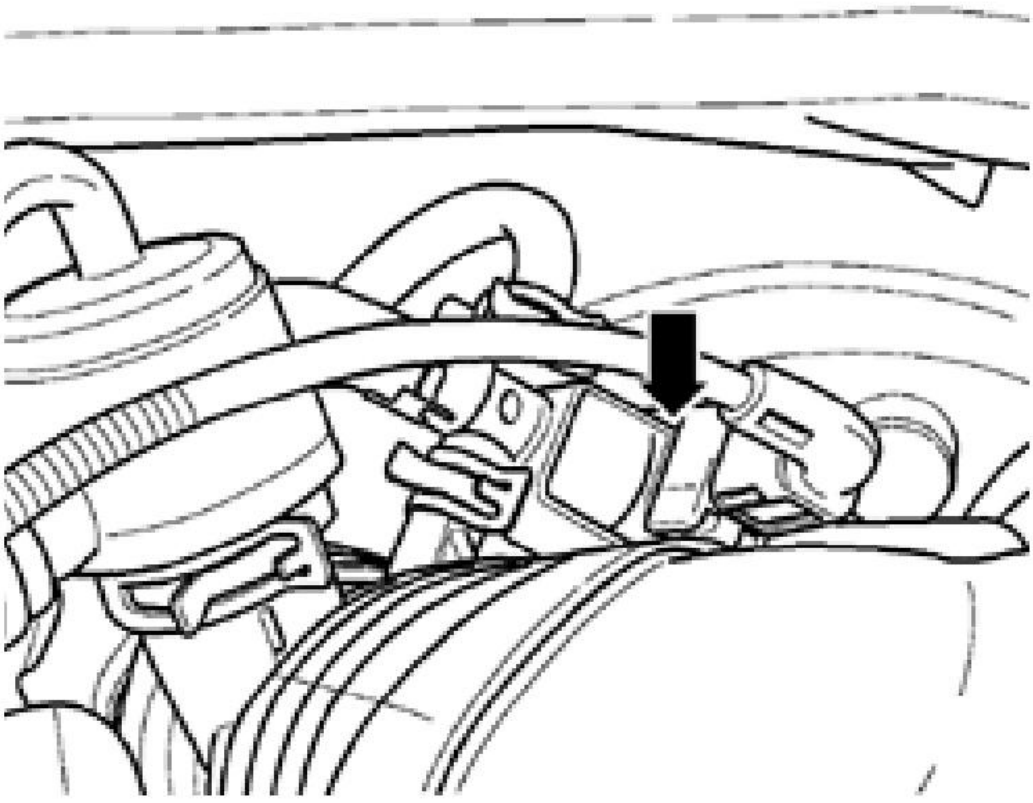
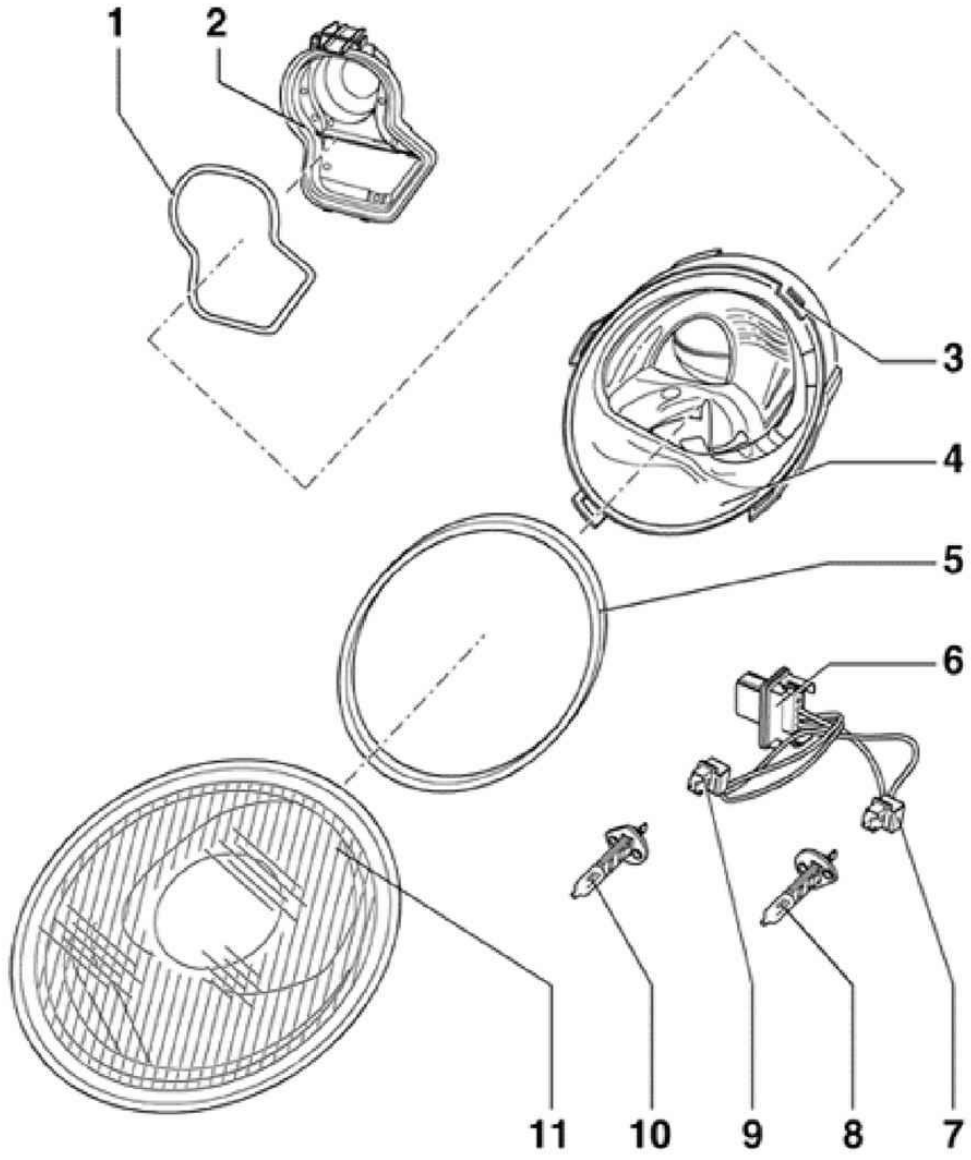


Fig. 16: Pulling 2-Pin Connector Off Wastegate Bypass Regulator Valve N75
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Measure resistance between valve contacts.

  Specification: 25-35 ohm



1 - Gasket

2 - Cover

3 - Retainers

4 - Headlight housing

5 - Gasket

6 - Harness connector

7 - Electrical connector for high beam bulb

8 - High beam bulb

9 - Electrical connector for low beam bulb

10 - Low beam bulb

11 - Headlight glass

Fig. 17: Measuring Resistance Between Valve Contacts
Courtesy of VOLKSWAGEN OF AMERICA, INC.

If the specification is not obtained:

- Replace Wastegate Bypass Regulator Valve -N75-.
- Check DTC memory.

  See Diagnostic Trouble Code (DTC) Memory, Checking And Erasing .

- Read readiness code.

  See Readiness Code, Displaying .

If the DTC memory has been erased or the engine control module separated from the permanent positive, the readiness code must be generated again.

See Readiness Code, Displaying .

If the specification is obtained:

- Check specified values in measuring value blocks for charge pressure regulation:

  Display groups 111 to 119

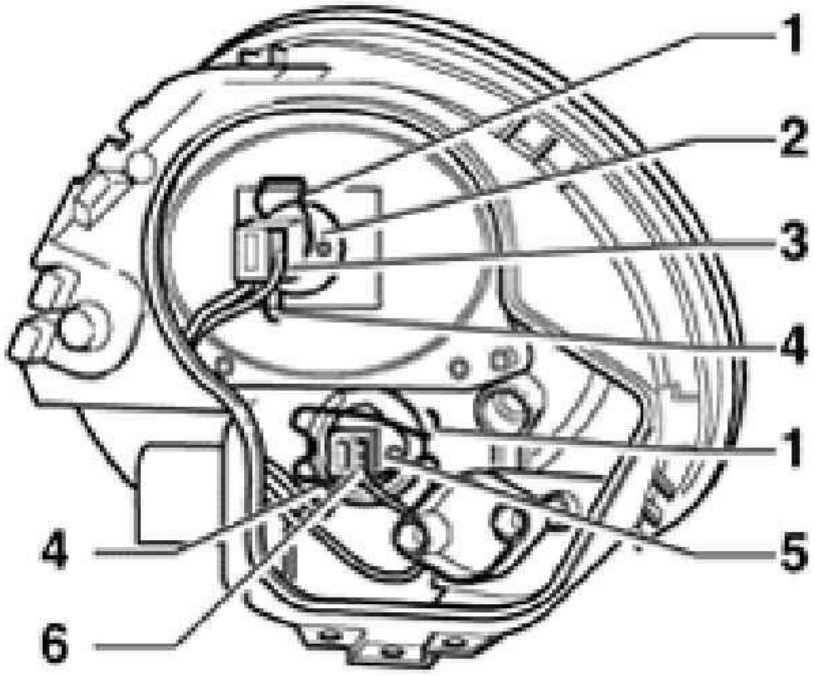
- Read Measuring Value Block, Display groups 110 to 119 -charge pressure control

  See Measuring Value Block, Evaluating Display Groups 110...119 (Charge Pressure Control)

Charge Air Pressure Sensor -G31-, checking

Special tools and equipment

- VAG 1526 A Hand multimeter
- VAG1594A Adapter set
- VAG 1598/31 Test box
- Wiring diagram



1 - Retaining clip

2 - High beam bulb

3 - Electrical connector for high beam

4 - Locating lugs

5 - Low beam bulb

6 - Electrical connector for low beam

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Fig. 18: Identifying Special Tools And Equipment

Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test conditions

- On Board Diagnostic (OBD) has detected a malfunction with the Charge Air Pressure Sensor. Check and erase DTC memory, if necessary:

  See Diagnostic Trouble Code (DTC) Memory, Checking And Erasing .

- Switch ignition off.

Checking voltage supply and wiring to control module

- Disconnect 4-pin connector 2 from Charge Air Pressure Sensor -G31-.

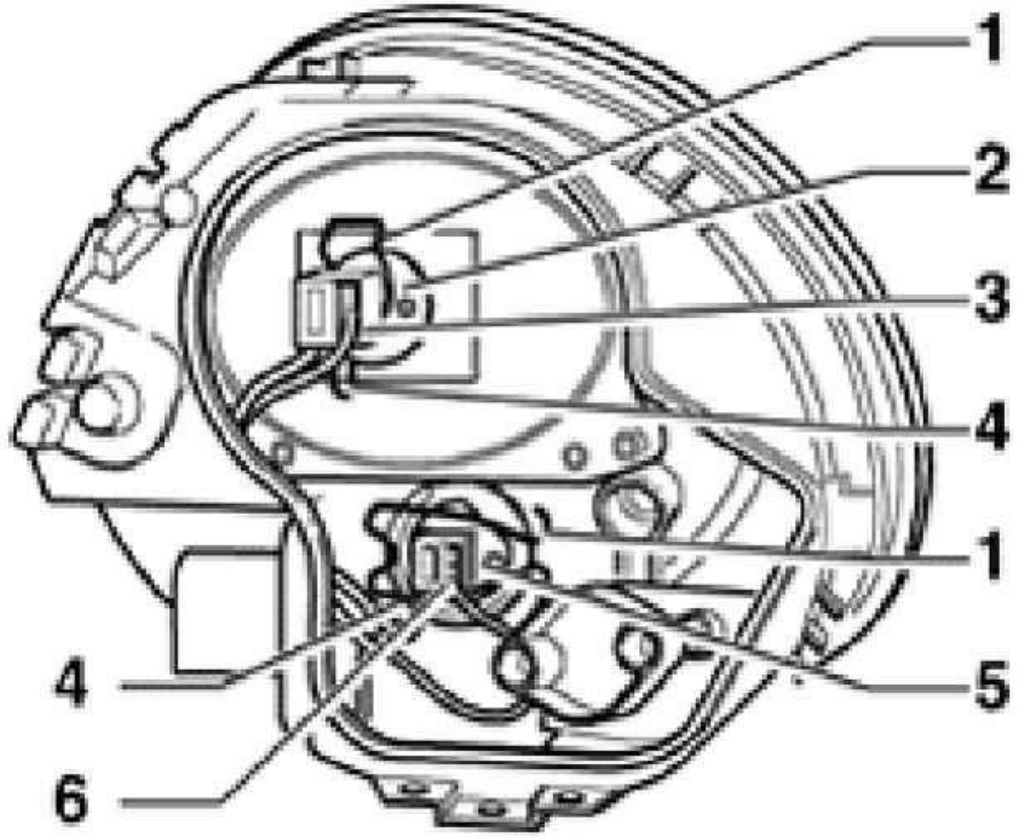

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Fig. 19: Disconnecting 4-Pin Connector 2 From Charge Air Pressure Sensor -G31-
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Connect multimeter to measure voltage using aux. cables from VAG1594 to contacts 1 (Ground) and 3 (positive) of connector for Charge Air Pressure Sensor.

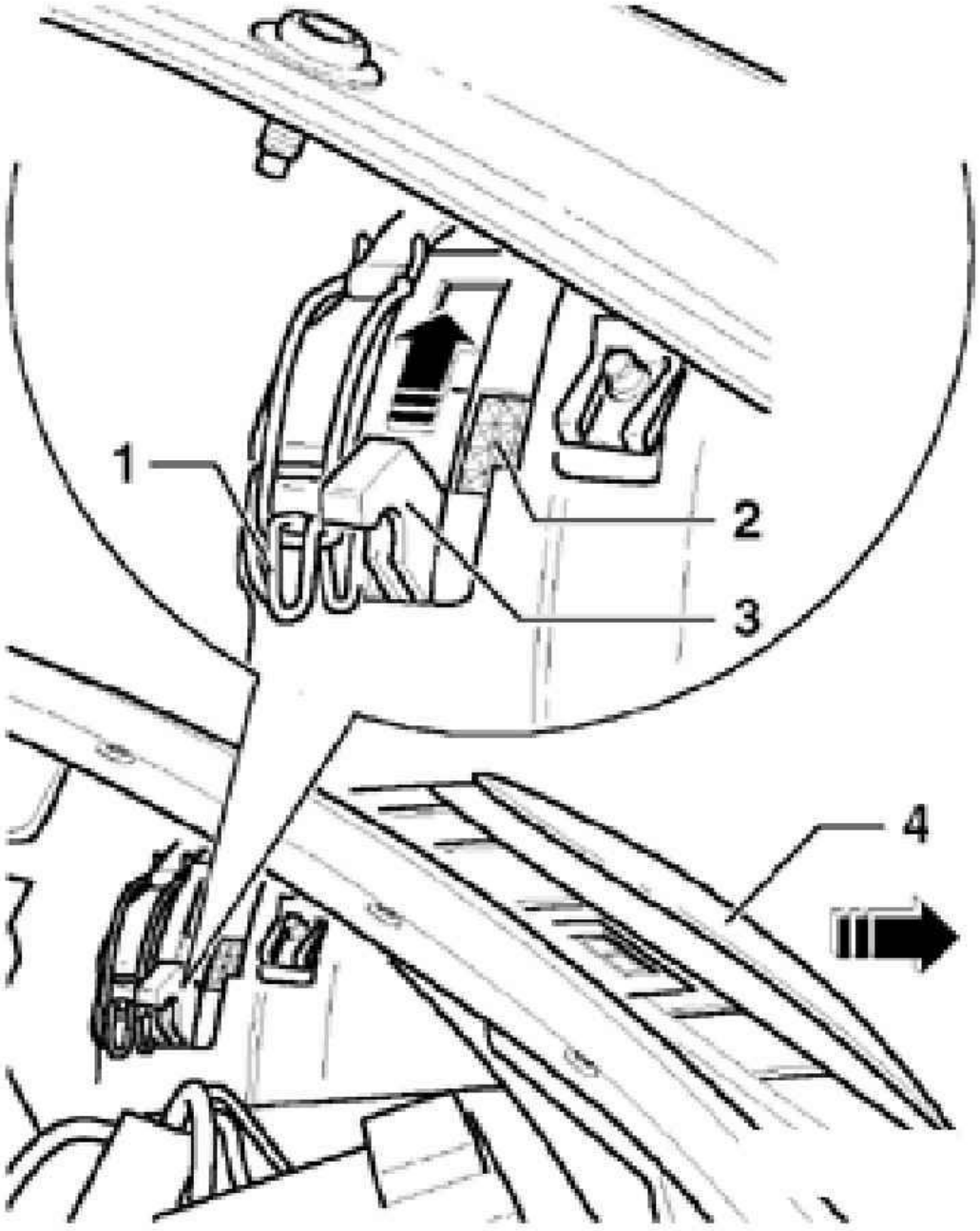

Fig. 20: Connecting Multimeter To Measuring Voltage To Contacts 1 And 3 Of Connector For Charge Air Pressure Sensor
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Switch ignition on.
- Specification: min. 4.5 V
- Switch ignition off.

If no voltage is present:

- Remove inner plenum chamber cover, left side.

  See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING**

- Connect test box VAG 1598/31 to control module wiring harness. Engine Control Module is not connected by this action.

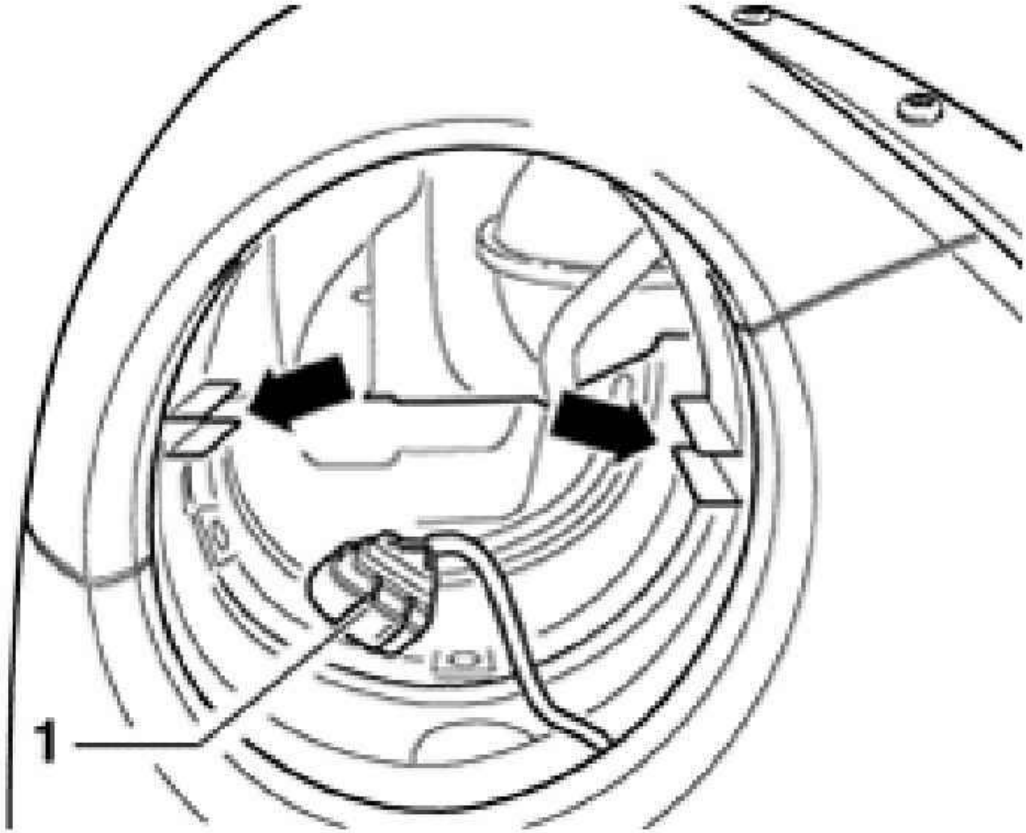

Fig. 21: Connecting Test Box VAG 1598/31 To Control Module Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring between test box and connector for open circuit according to wiring diagram.

  Terminal 1 + socket 108

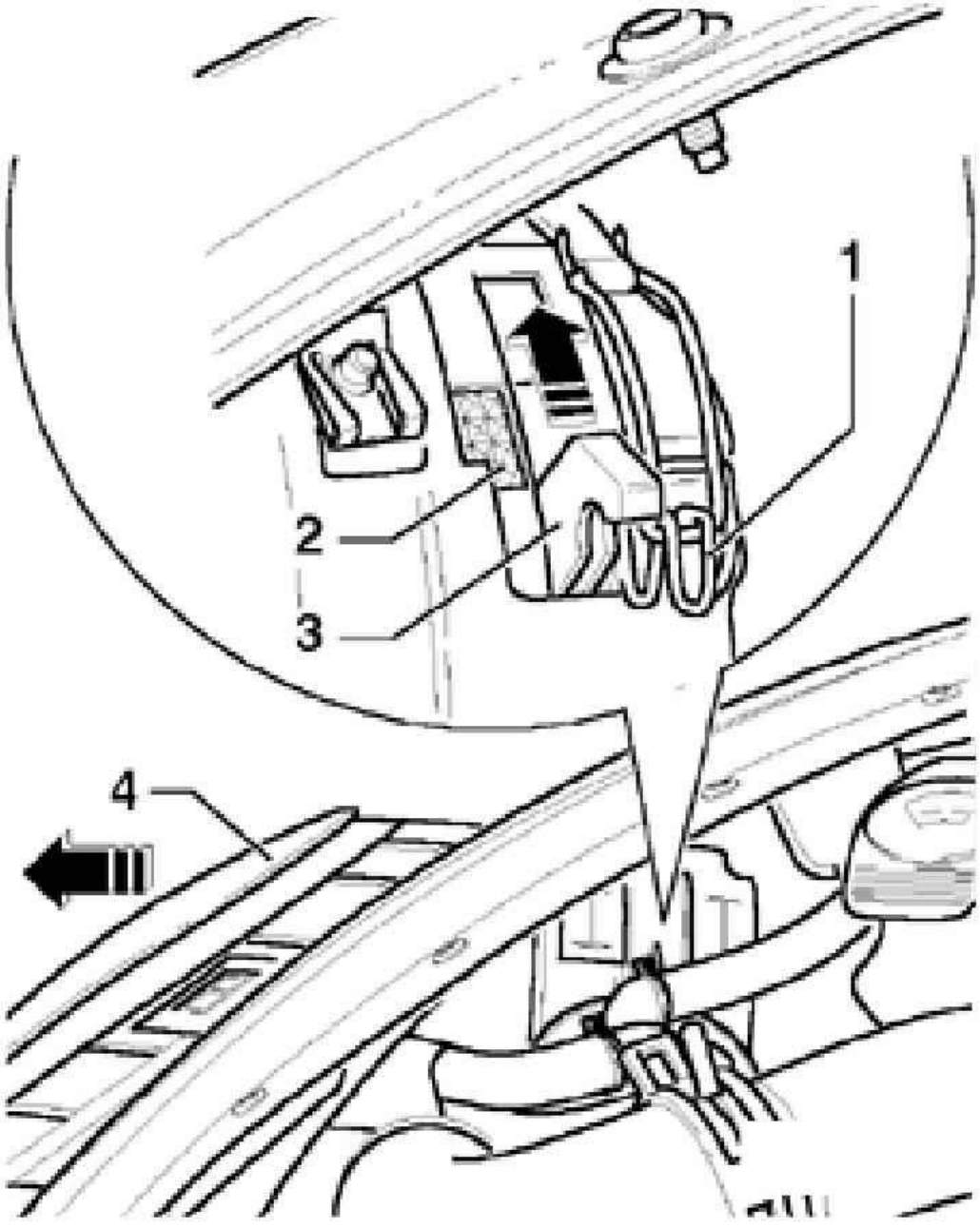

Fig. 22: Identifying Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Terminal 3 + socket 98

Terminal 4 + socket 101

Wire resistance: Max. 1.5 ohm

- Additionally, check wires for short to one another.

If no wiring malfunction is detected and voltage was present between terminals 1 + 3:

- Check function. See **CHECKING FUNCTION** .

If no wiring malfunction is detected and no voltage was present between terminals 1 + 3:

- Replace engine control module.

See Engine Control Module (ECM), Replacing .

Checking function

- Remove inner plenum chamber cover, left side.

  See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING** .

- Connect VAG 1598/31 test box to wiring harness for control module and to control module.
- Re-connect connector at Charge Air Pressure Sensor -G31-.
- Connect multimeter to measure voltage to sockets 101 (positive) and 108 (Ground) using adapter cables from VAG 1594.
- Start engine and measure basic voltage.

  Specification: 1.80 to 2.00 V

- Bring engine to specified RPM by quickly depressing accelerator pedal.

  Specification: 2.00 to 3.00 V

If the specifications are not obtained:

- Replace Charge Air Pressure Sensor -G31-.
- Check DTC memory.

  See Diagnostic Trouble Code (DTC) Memory, Checking And Erasing .

- Read readiness code.

See Readiness Code, Displaying .

If the DTC memory has been erased or the engine control module separated from the permanent positive, the readiness code must be generated again.

See Readiness Code, Displaying .

Recirculating valve for turbocharger -N249-, checking

Special tools and equipment

- VAG 1551 Scan Tool (or vehicle system tester VAG 1552 with cable VAG 1551/3B)
- VAG 1526 Hand multimeter or VAG 1715 multimeter
- VAG 1594A Adapter set

Test conditions

- Output Diagnostic Test Mode (DTM) completed

See Output Diagnostic Test Mode (DTM) .

Test sequence

- Switch ignition off.
- Disconnect connector from Recirculating valve for turbocharger -N249-.

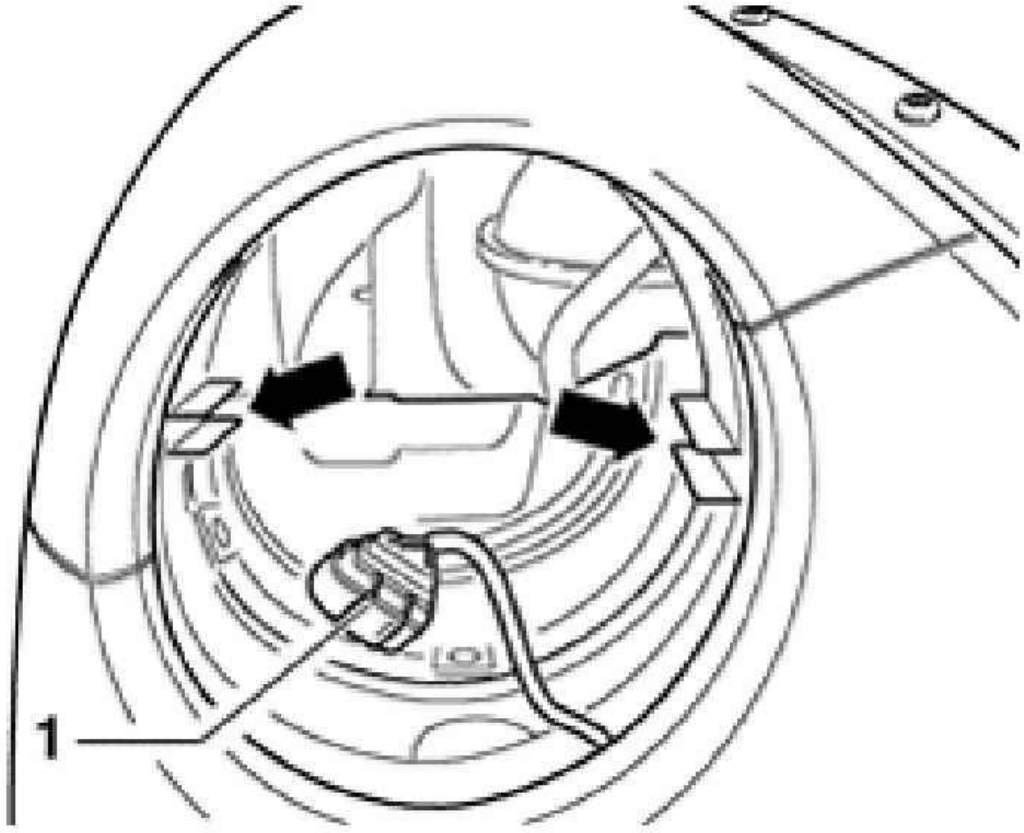

Fig. 23: Locating Recirculating Valve For Turbocharger
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Measure resistance between valve terminals.

  Specification: 27 to 30 ohm

If the specification is not obtained:

- Replace Recirculating valve for turbocharger -N249-.
- Check DTC memory.

  See Diagnostic Trouble Code (DTC) Memory, Checking And Erasing .

- Read readiness code.

See Readiness Code, Displaying .

If the DTC memory has been erased or the Engine Control Module separated from permanent (battery) positive, the readiness code must be generated again.

See Readiness Code, Displaying .

- Repeat test sequence.

If the specification is not obtained:

- Check wiring for open circuit or short to positive according to wiring diagram.

  See appropriate SYSTEM WIRING DIAGRAM article.

If no wiring problem is detected:

- Replace Engine Control Module (ECM).

  See Engine Control Module (ECM), Replacing .

- Check activation of Recirculating valve for turbocharger -N249-.

  See Output Diagnostic Test Mode (DTM) .

Pressure unit for Wastegate Bypass Regulator Valve -N75-, checking

Special tools and equipment

- VAG 1551 Scan Tool (or VAG 1552 vehicle system tester with VAG 1551/3B cable)

Test conditions

- Engine oil temperature min. 60° C
- No leaks on intake and exhaust systems.

Test sequence

- Disconnect connector -2- from Wastegate Bypass Regulator Valve -N75- -1-.

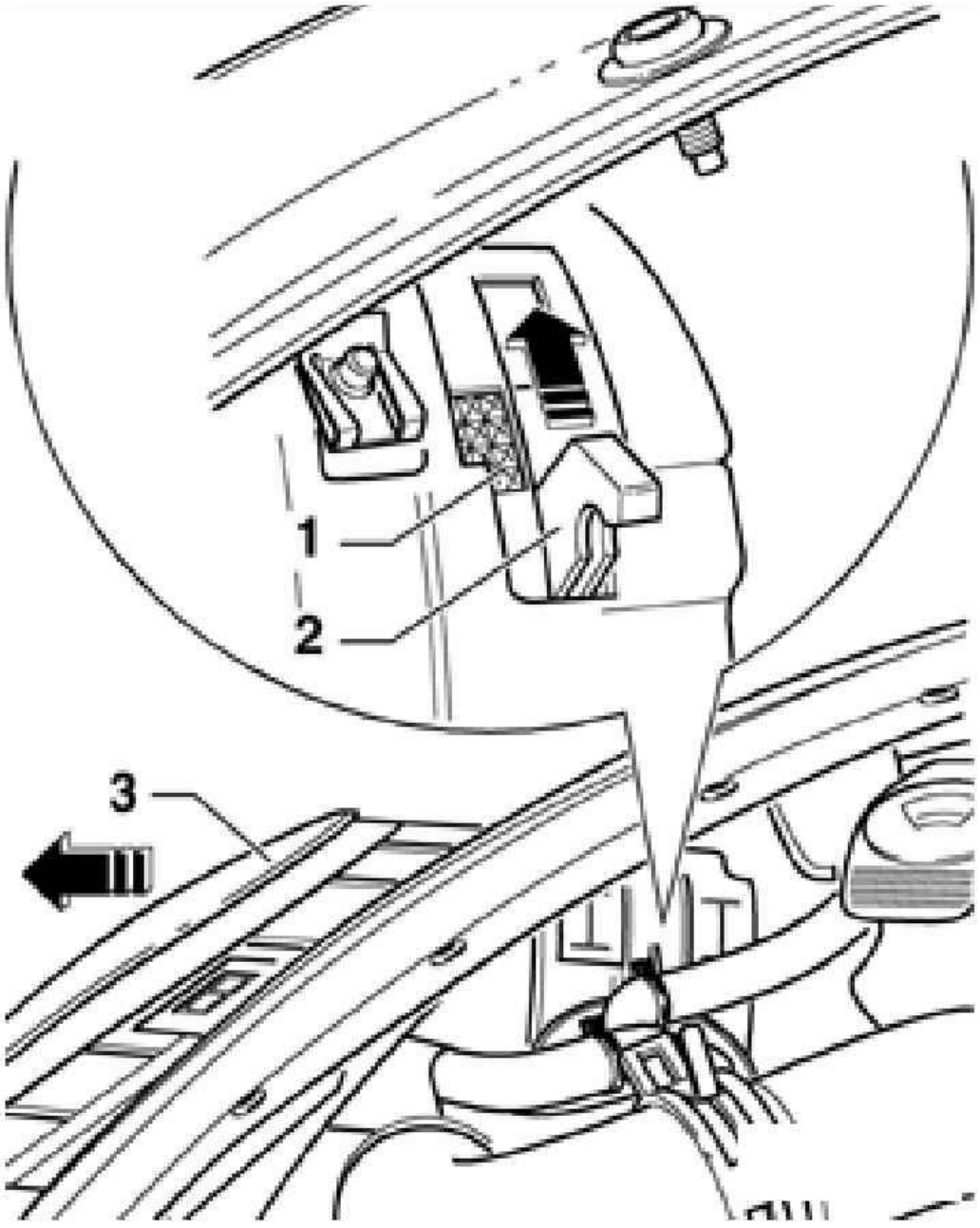

Fig. 24: Disconnecting Connector From Wastegate Bypass Regulator Valve N75
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Start engine and raise to maximum speed briefly by operating throttle.

  Operating rod -2- for Wastegate Bypass Regulator Valve must move.

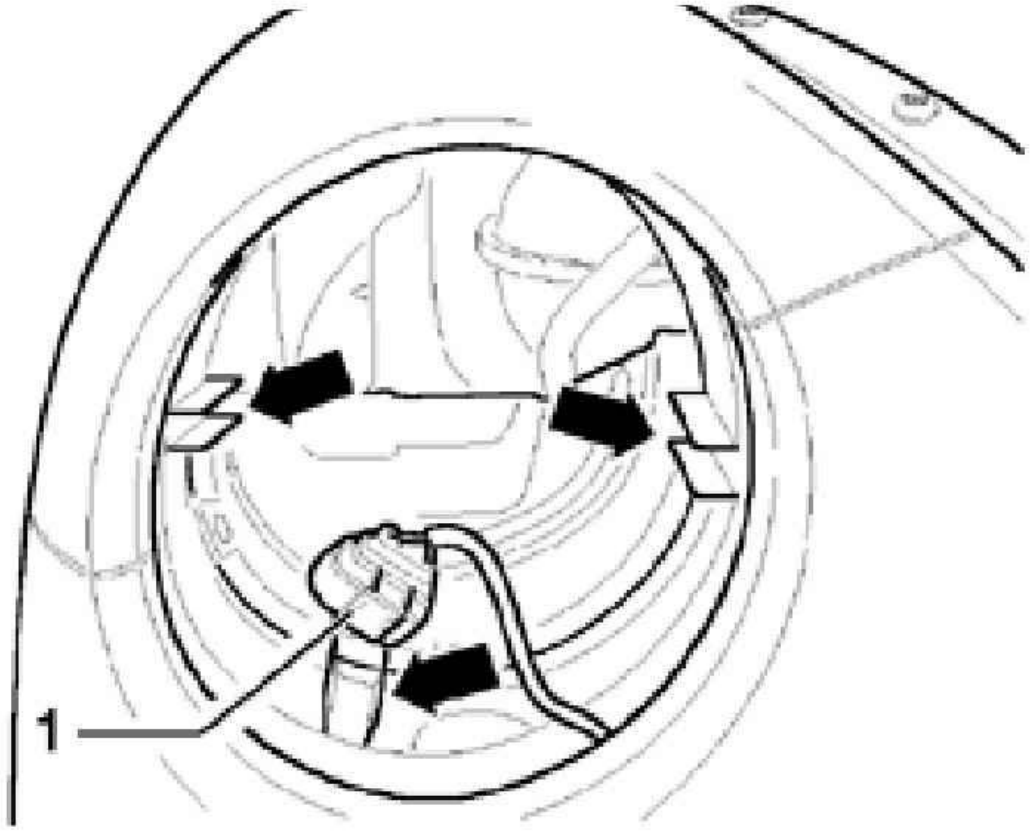

Fig. 25: Checking Charge Pressure Control Valve Lever For Ease Of Movement
Courtesy of VOLKSWAGEN OF AMERICA, INC.

If the operating rod does not move:

- Check charge pressure control valve lever -1- for ease of movement. When corroded together, replace turbocharger.

If the operating rod does not move, even though the lever is free to move:

- Replace exhaust turbocharger. See **Turbocharger with attachments, removing and installing Part II** , item 6.

- Check DTC memory.

  See Diagnostic Trouble Code (DTC) Memory, Checking And Erasing .

- Read readiness code.

  See Readiness Code, Displaying .

If the DTC memory has been erased or the Engine Control Module separated from the permanent (battery) positive, the readiness code must be generated again.

See Readiness Code, Displaying .

Charge pressure bypass valve, checking

Special tools and equipment

- VAG 1390 Hand vacuum pump

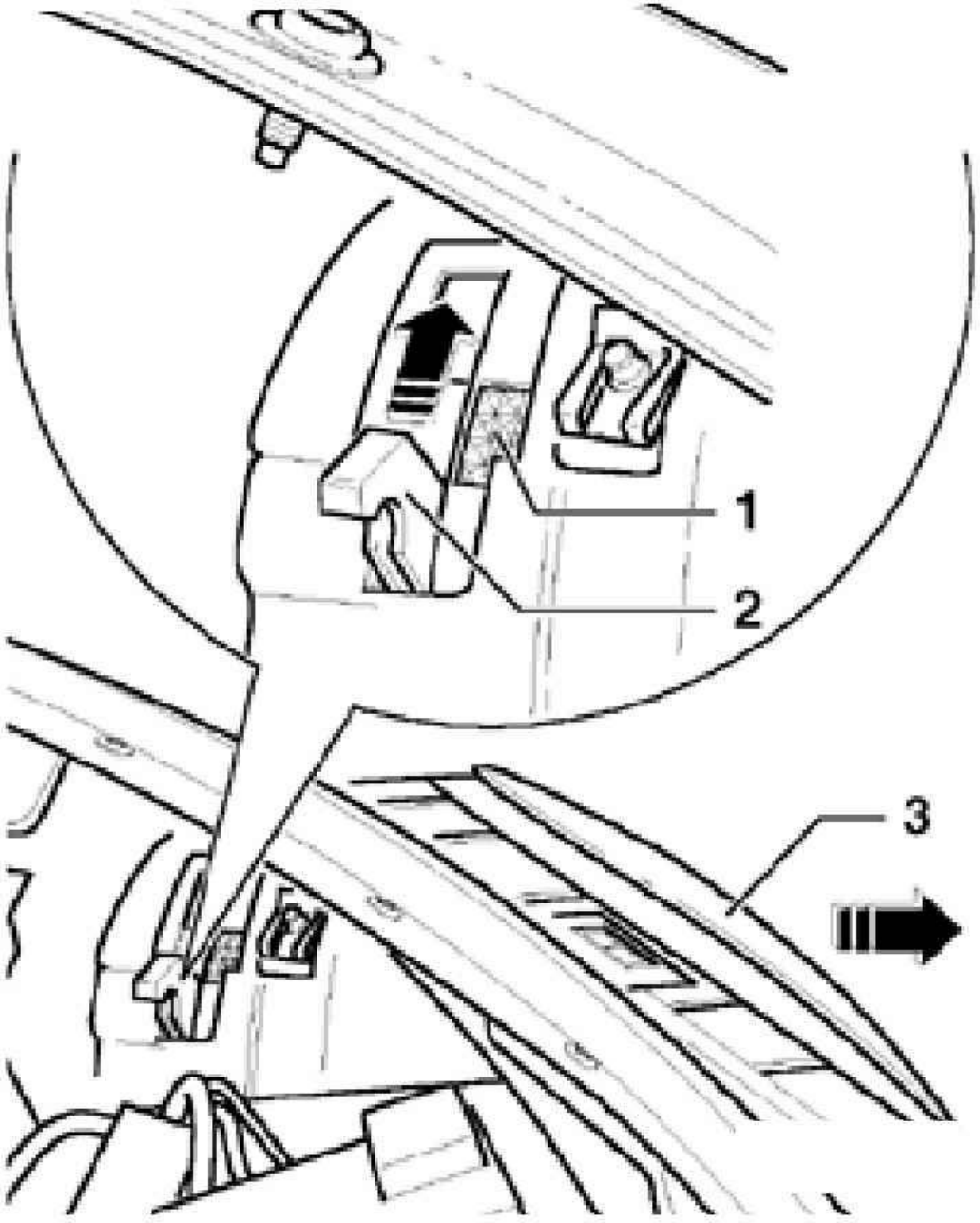

Fig. 26: Identifying VAG 1390 Hand Vacuum Pump
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test conditions

- Reduced performance or load change shudders
- Turbocharging noises during closing of throttle valve

Test sequence

NOTE: The charge pressure bypass valve is located in front of the turbocharger. It is opened by vacuum pressure during the overrun phase and at idling speed.

- Connect hand vacuum pump VAG 1390 to vacuum connection on charge pressure bypass valve.

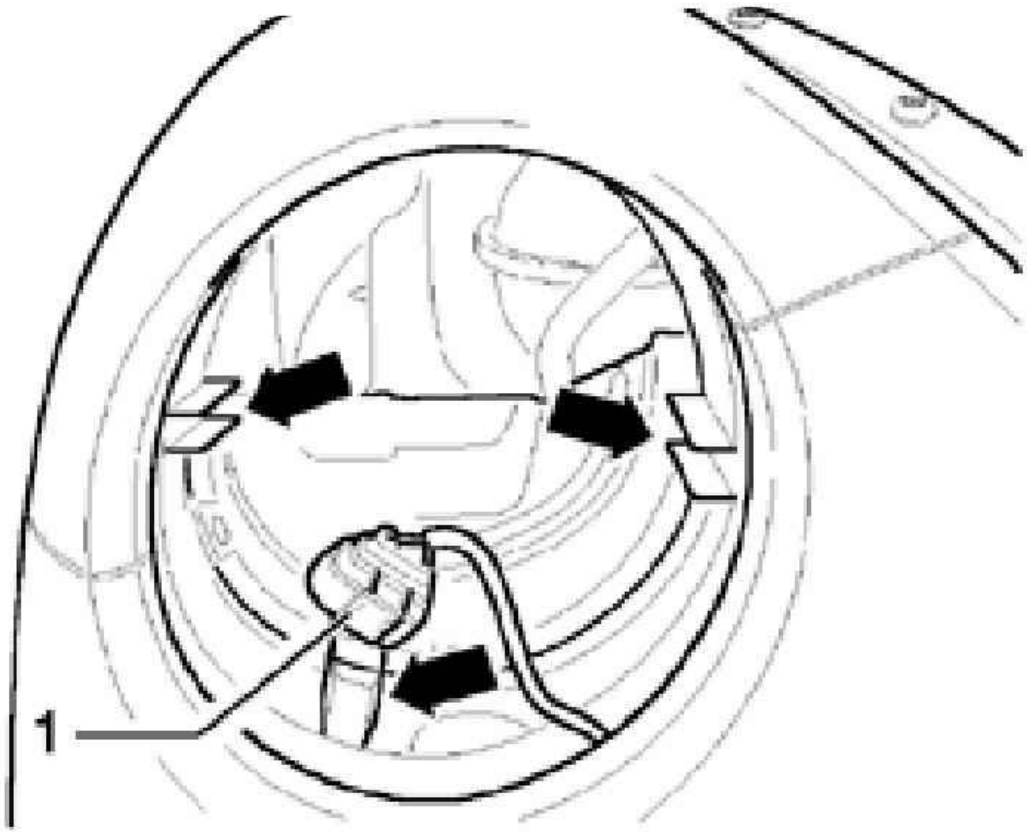

Fig. 27: Connecting Hand Vacuum Pump VAG 1390 To Vacuum Connection On Charge Pressure Bypass Valve
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Operate hand vacuum pump.

Charge pressure bypass valve must open in direction of -arrow-.

- Operate vent valve on hand vacuum pump.

  Valve must close -arrow-.

- If valve does not open or close, replace valve.

NOTE: **The charge pressure bypass valve connections are secured with screw-type clamps.**

EXHAUST SYSTEM, EMISSION CONTROLS

EXHAUST SYSTEM COMPONENTS, REMOVING AND INSTALLING

NOTE:

- **After working on the exhaust system ensure that the system is not under stress, and that it has sufficient clearance from the bodywork. If necessary, loosen double and single clamps and align muffler and exhaust pipe so that sufficient clearance is maintained to the bodywork and the support rings are evenly loaded.**
- **Always replace self-locking nuts.**

Checking catalyst. See **CATALYST, CHECKING**

Special tools and equipment

- 3337 Ring spanner for oxygen sensor

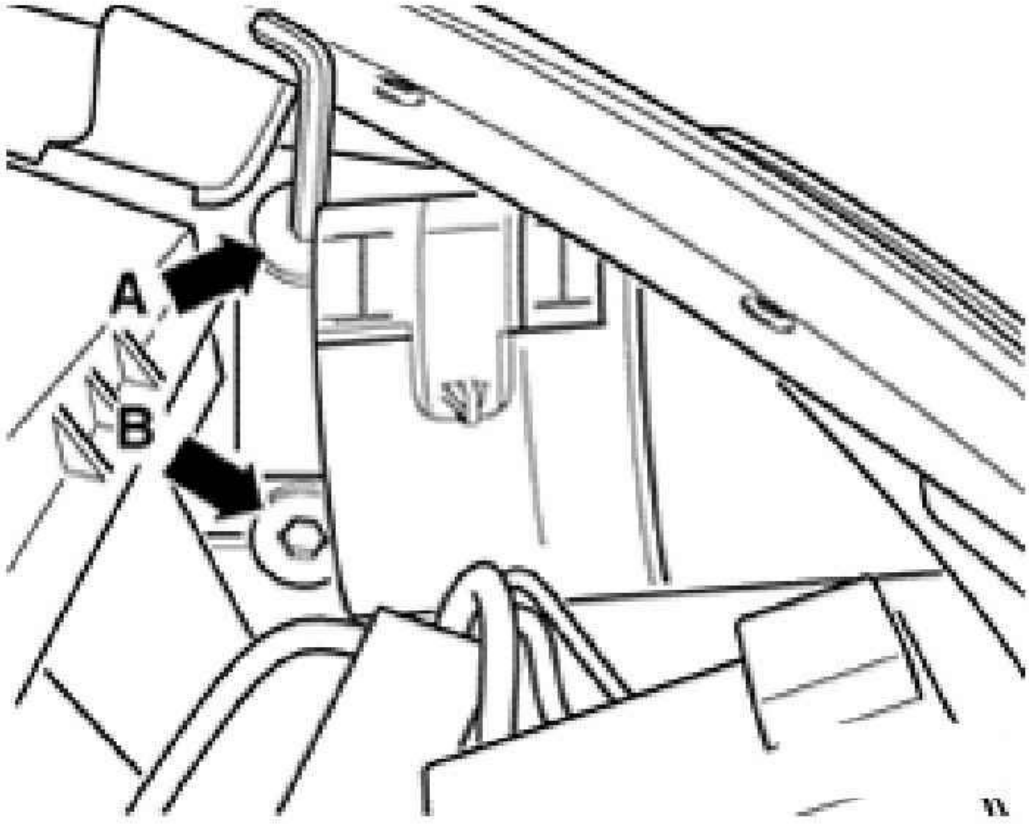

Fig. 28: Identifying 3337 Ring Spanner For Oxygen Sensor
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Exhaust manifold, front exhaust pipe and catalyst with attachments

NOTE: The following list refers to items in Fig. 29 .

1. **Turbocharger**
2. **Gasket for front exhaust pipe**
   - Always replace
3. **Front exhaust pipe with catalyst**
4. **Oxygen sensor 1 before catalyst -G39-, 50 N.m**
   - Grease only the threads with G 052 112 A3; G 052 112 A3 must not get into the slots on the probe body

- Remove and install with ring spanner 3337
- Checking:

  See Oxygen Sensor And Oxygen Sensor Control Before Catalyst, Checking .

5. **6-pin connector**
   - Black
   - For oxygen sensor 1 before catalyst -G39- and oxygen sensor heating -Z19-
   - Right on underside of vehicle
6. **4-pin connector**
   - Brown
   - For oxygen sensor 2 after catalyst - G130- and oxygen sensor heating -Z29-
7. **Oxygen sensor 2 after catalyst -G130-, 50 N.m**
   - Installation location: in catalyst
   - Grease only the threads with G 052 112 A3; G 052 112 A3 must not get into the slots on the probe body
   - Remove and install with ring spanner 3337
   - Checking:

     See Oxygen Sensor And Oxygen Sensor Control After Catalyst, Checking .

8. **To center muffler**
9. **40 N.m**
   - Always replace

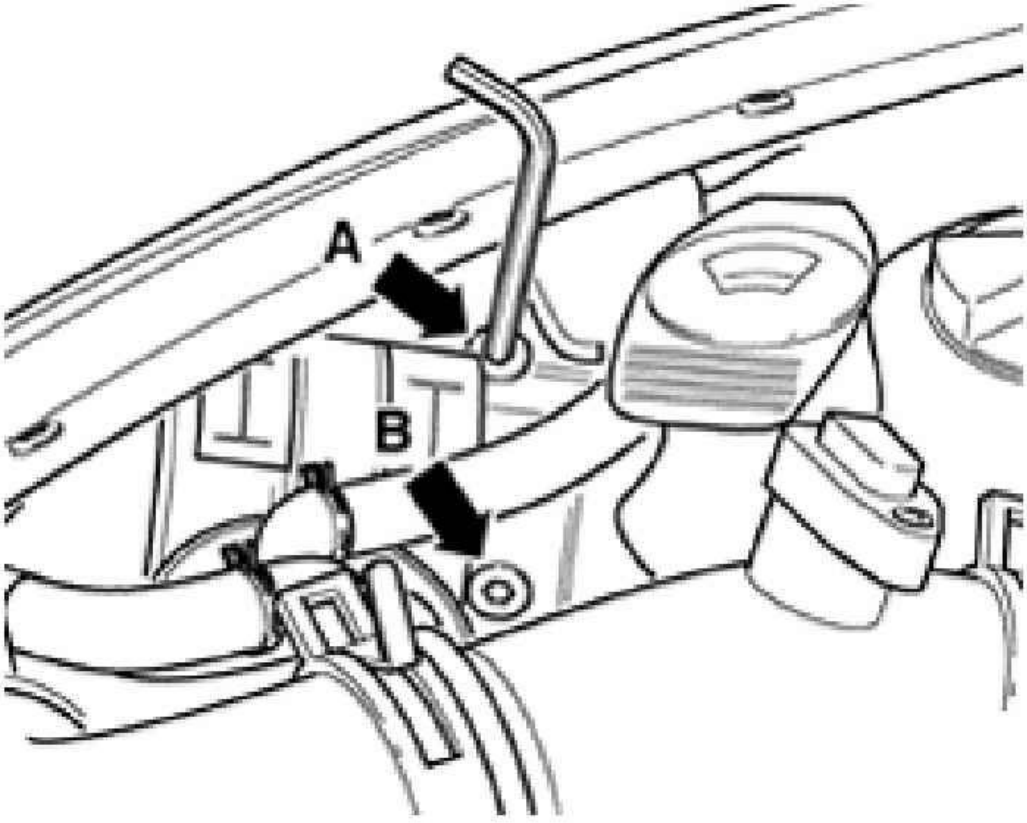

Fig. 29: Identifying Components Of Exhaust Manifold, Front Exhaust Pipe And Catalyst With Attachments
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Muffler with mounts

NOTE: The following list refers to items in Fig. 30 .

1. **From catalyst**
2. **Double clamp**
   - Note installation position. See **Checking Installation Position Of Double Clamp**
3. **25 N.m**
4. **Mount**
   - Note installation position. See **Installation Position Of Mount**

5. **Center muffler**
    - Aligning. See **Aligning Central Muffler Stress Free**
6. **Separating point**
    - As standard, center and rear mufflers are installed as a single component. In cases of repair the center and rear muffler are supplied individually and with a double clamp for connecting
    - Cut through connecting pipe with body saw e.g. VAG1523at right angles at the separating point. See **Separating Point On Exhaust Pipe**
7. **Mount**
8. **Bracket**
9. **Rear muffler**
10. **Mount**
    - With retaining ring
11. **20 N.m**
12. **Tunnel bridge**
13. **40 N.m**
14. **Washer**

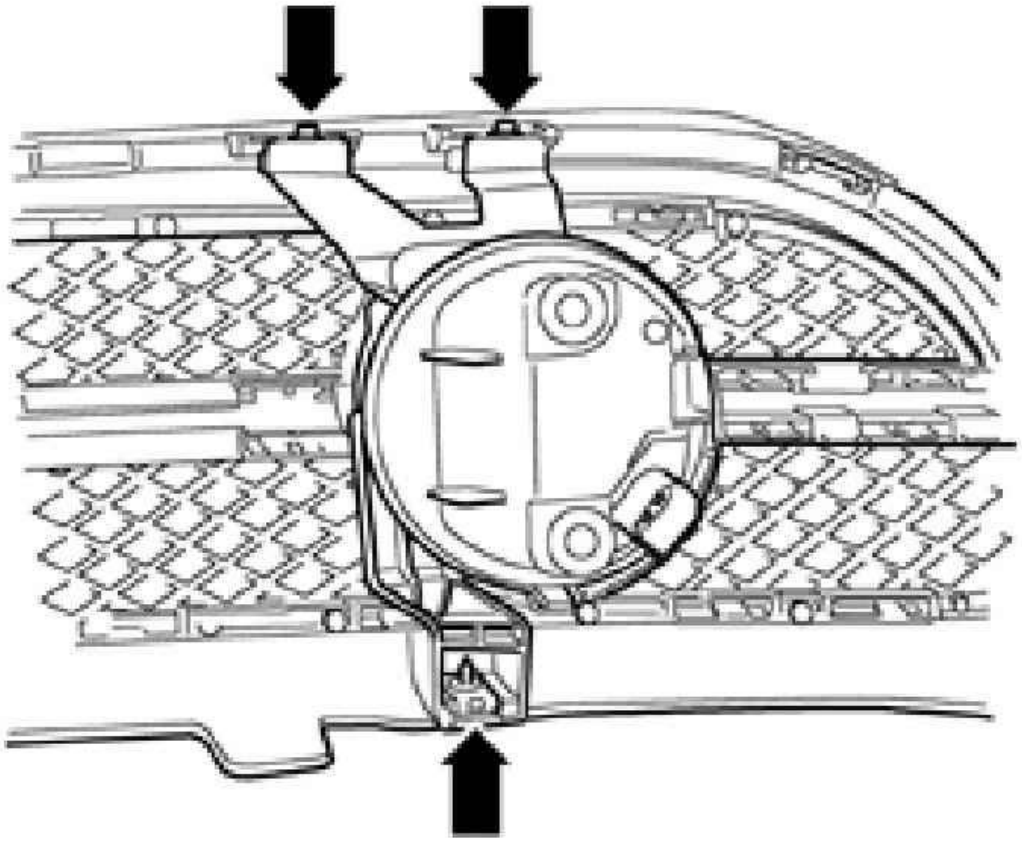

Fig. 30: Identifying Muffler With Mounts
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Checking Installation Position Of Double Clamp

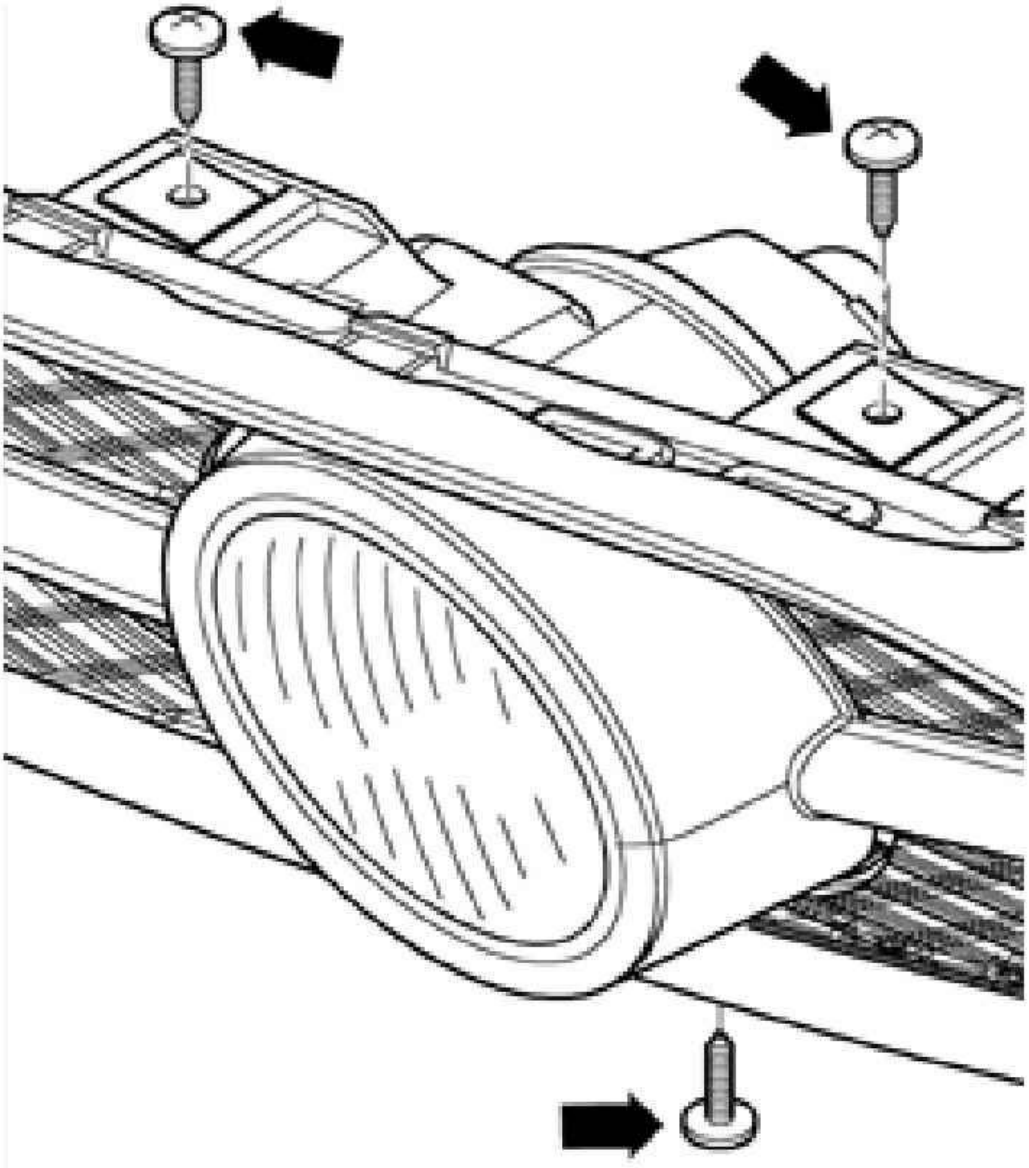

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Fig. 31: Checking Installation Position Of Double Clamp
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Position double clamp with approx. 5 mm clearance to the appropriate marking.
  - Marking A (-arrow 1 -) for vehicles with automatic transmission
  - Marking S (-arrow 2-) for vehicles with manual transmission

Installation Position Of Mount

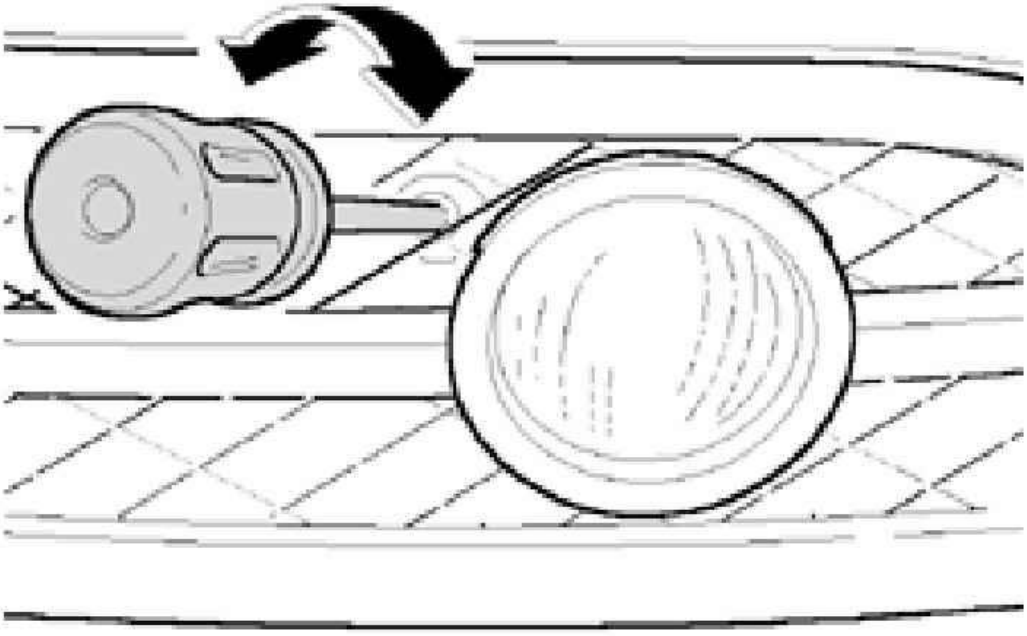


Fig. 32: Identifying Installation Position Of Mount
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Angled side on foot of mount (-arrow-) points forward.

Separating Point On Exhaust Pipe

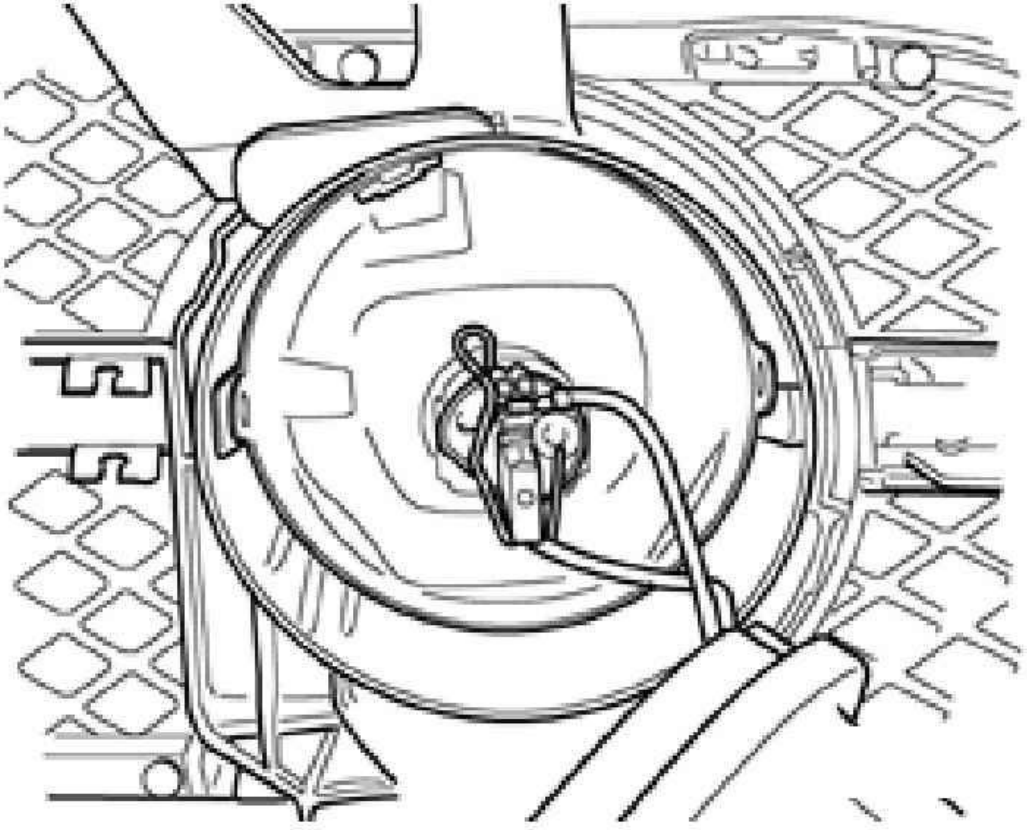
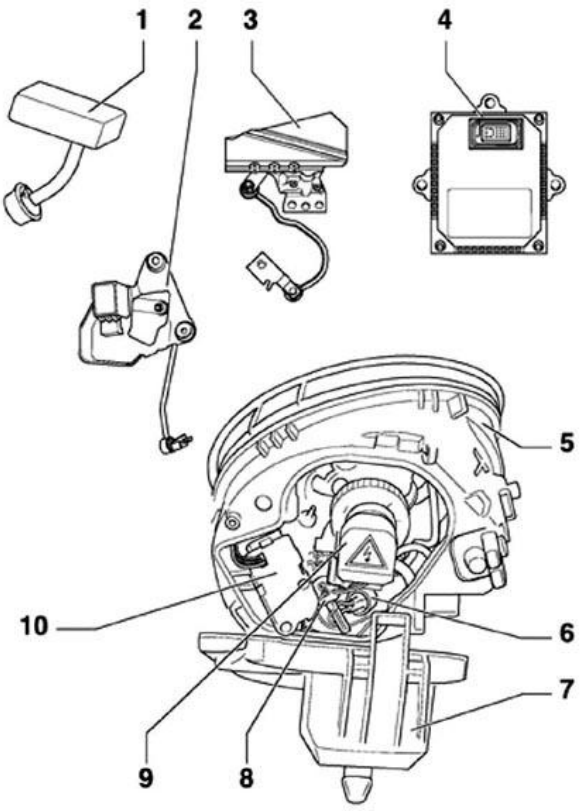


Fig. 33: Identifying Separating Point On Exhaust Pipe
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Separate exhaust pipe at right angles at separating point -arrow 2-.
- When installing fit repair type double clamp -4- at side markings -arrows 1 and 3-.

  Tightening torque: 40 N.m

Aligning Central Muffler Stress Free



1 - Left/Right Control Module for High Intensity Gas Discharge (HID) Lamp -J343- / -J344-

2 - Left Front Level Control System Sensor -G78-

3 - Left Rear Level Control System Sensor -G76-

4 - Left/Right High Intensity Gas-discharge Lamp (with range control) Control Module - J567- / -J568-

5 - Headlight housing

6 - Parking light bulb

7 - Sealing cap

8 - High beam bulb

9 - High Intensity Gas Discharge (HID) lamp

10 - Headlight beam adjusting motor - V48- / -V49-

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Fig. 34: Aligning Central Muffler Stress Free
Courtesy of VOLKSWAGEN OF AMERICA, INC.

The support pin on exhaust pipe must align parallel with tunnel bridge (dimension -x- on left and right the

same).

Catalyst, checking

Special tools and equipment

- VAG1551 Scan tool

NOTE: The VAG1552 vehicle system tester can be used instead of the VAG1551 Scan Tool, but a print-out is not possible.

- VAG1551/3B Cable
- VAG1788/10 speed regulator

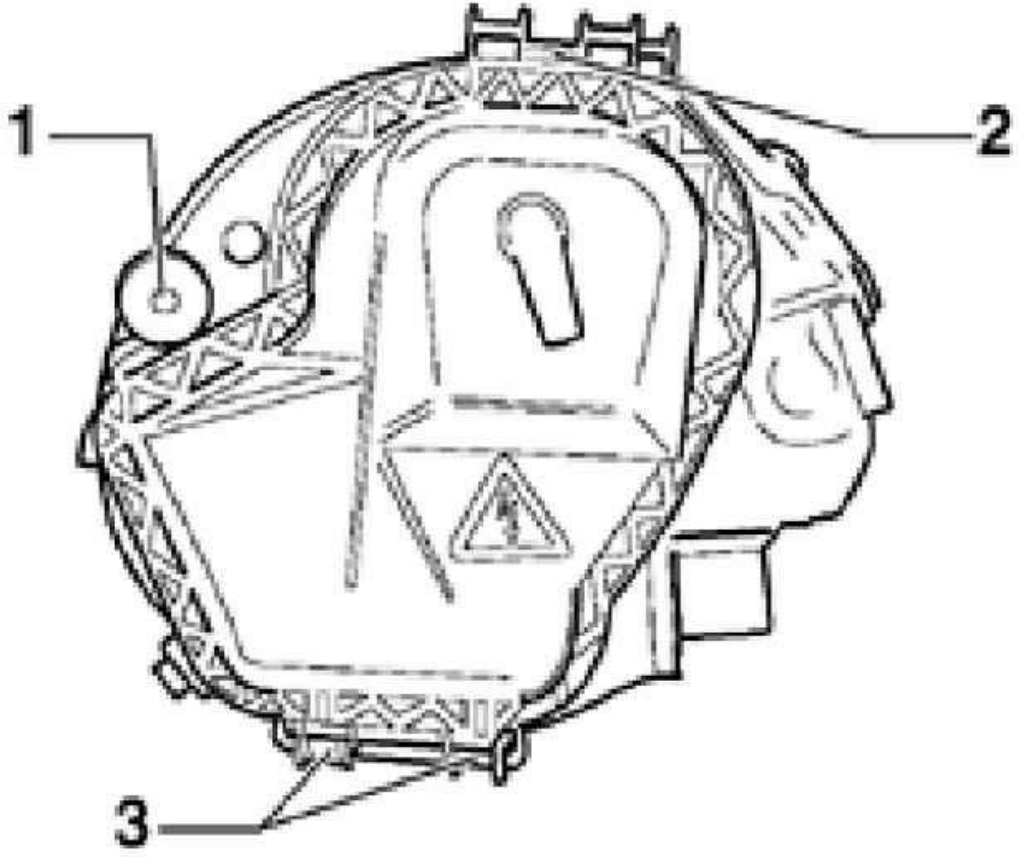

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Fig. 35: Identifying Special Tools And Equipment
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test sequence

- Connect VAG1551 Scan Tool (VAG1552). Start engine and select engine control module with "Address word" 01. Connecting scan tool and selecting engine control module:

  See V.A.G 1551 Scan Tool, Connecting And Selecting Engine Control Module .

NOTE: The diagnosis will only be terminated if the oxygen sensor ageing diagnosis is first successfully completed.

Indicated on display:

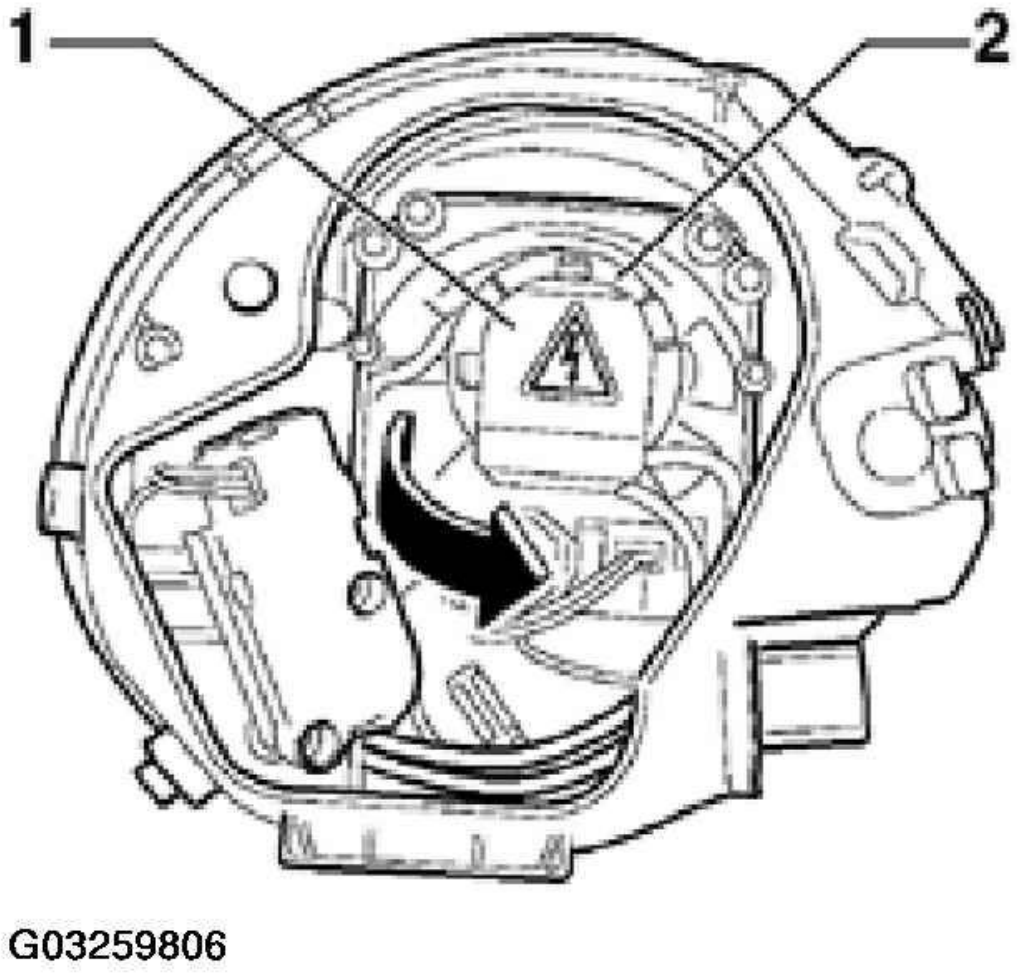

Fig. 36: V.A.G 1551 Scan Tool Display - Checking Catalyst (1 Of 6)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press keys 0 and 4 for the function "Introduction of basic setting" and confirm entry with Q key.

Indicated on display:

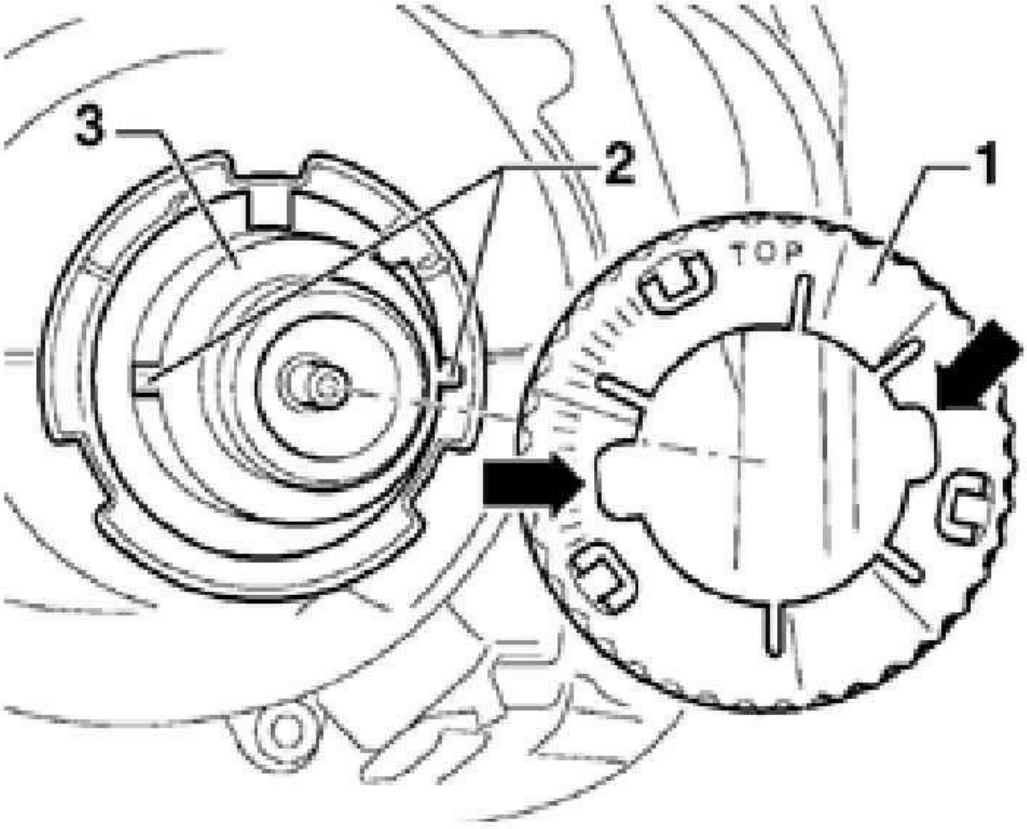

Fig. 37: V.A.G 1551 Scan Tool Display - Checking Catalyst (2 Of 6)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press keys 0, 3 and 4 for display group number 34 and confirm entry with Q key.

Indicated on display: (1 to 4 = Display zones)

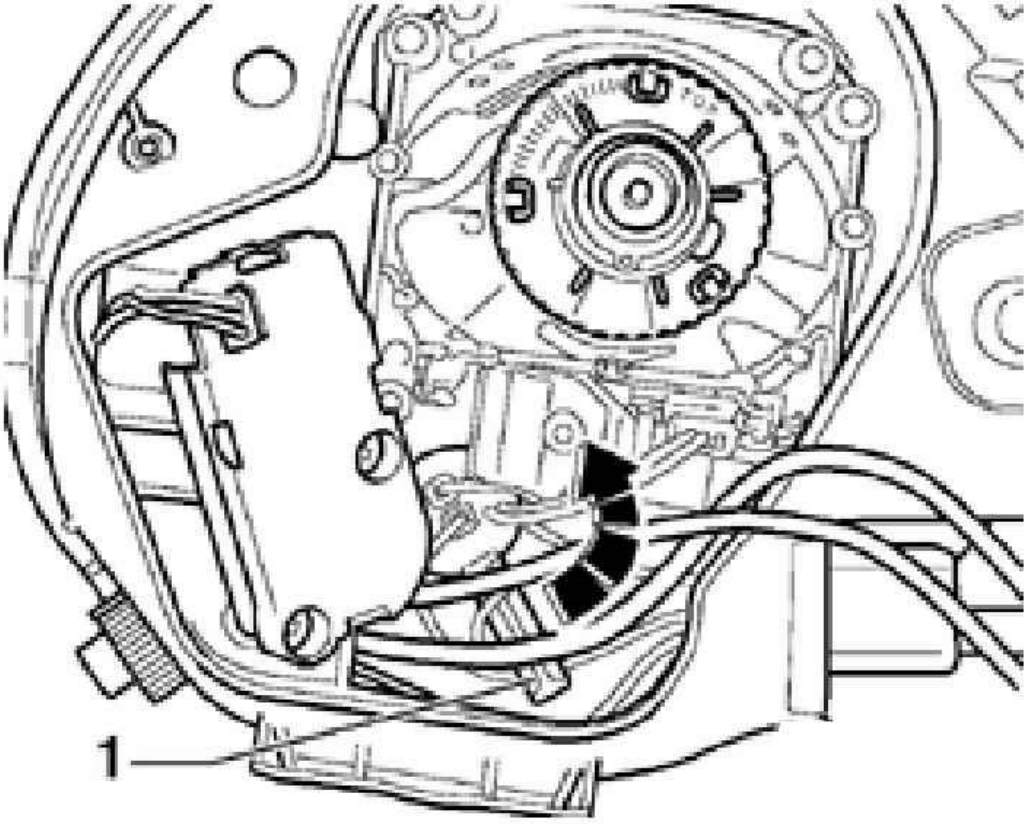

Fig. 38: V.A.G 1551 Scan Tool Display - Checking Catalyst (3 Of 6)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Set engine speed to 1800 to 2200 RPM using speed regulator V.A.G 1788/10:
- Maintain engine speed at 1800 to 2200 RPM until catalytic converter temperature in display zone 2 is between 350 and 500° C.

If the diagnosis is initiated from the engine control module the display in display zone 4 jumps from "Test OFF" to "Test ON."

- Check cycle duration in display zone 3:

  Specification: maximum 1.99

- Continue to maintain speed at 1800 to 2200 RPM until specification "B1-S1 OK" appears in display zone 4.

DISPLAY ZONES

	Display zones			
	1	**2**	**3**	**4**
Display group 34: Oxygen sensor aging diagnostic Bank 1 (sensor dynamics)				
Display	xxxx RPM	xxx.x° C	xx.xx	**Test OFF/Test ON B1-S1 OK/B1-S1 n.OK**
Indicated	Engine speed (in steps of 40)	Catalyst temperature	Sensor dynamics Bank 1 oxygen sensor 1	Diagnostic condition and diagnostic result
Working range	0 to 6800 RPM	-	0.00 to 1.99	-
Specified value	1800 to 2200 RPM	> 350 °C	> 0.50	**B1-S1 OK**

If the display does not indicate as described:

- Remove engine speed adjuster VAG1788/10 from accelerator pedal.
- Press --> key.
- Check DTC memory:

  See Diagnostic Trouble Code (DTC) Memory, Checking And Erasing .

- Read out readiness code:

  See Readiness Code, Displaying .

If DTC memory has been erased or the engine control module separated from the permanent positive, the readiness code must be generated again.

See Readiness Code, Displaying .

If the display indicates as described:

- Press C key.

Indicated on display:

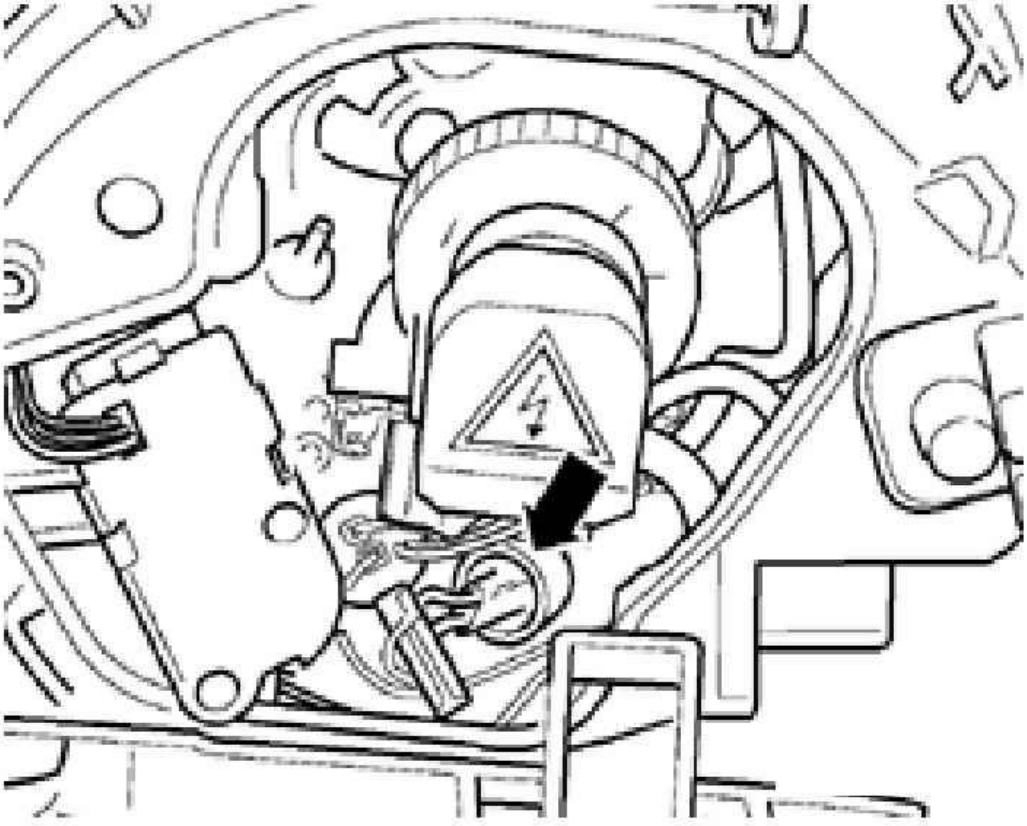

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Fig. 39: V.A.G 1551 Scan Tool Display - Checking Catalyst (4 Of 6)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press keys 0, 4 and 6 for "display group number 46" and confirm entry with Q key.

Indicated on display: (1-4 = Display zones)

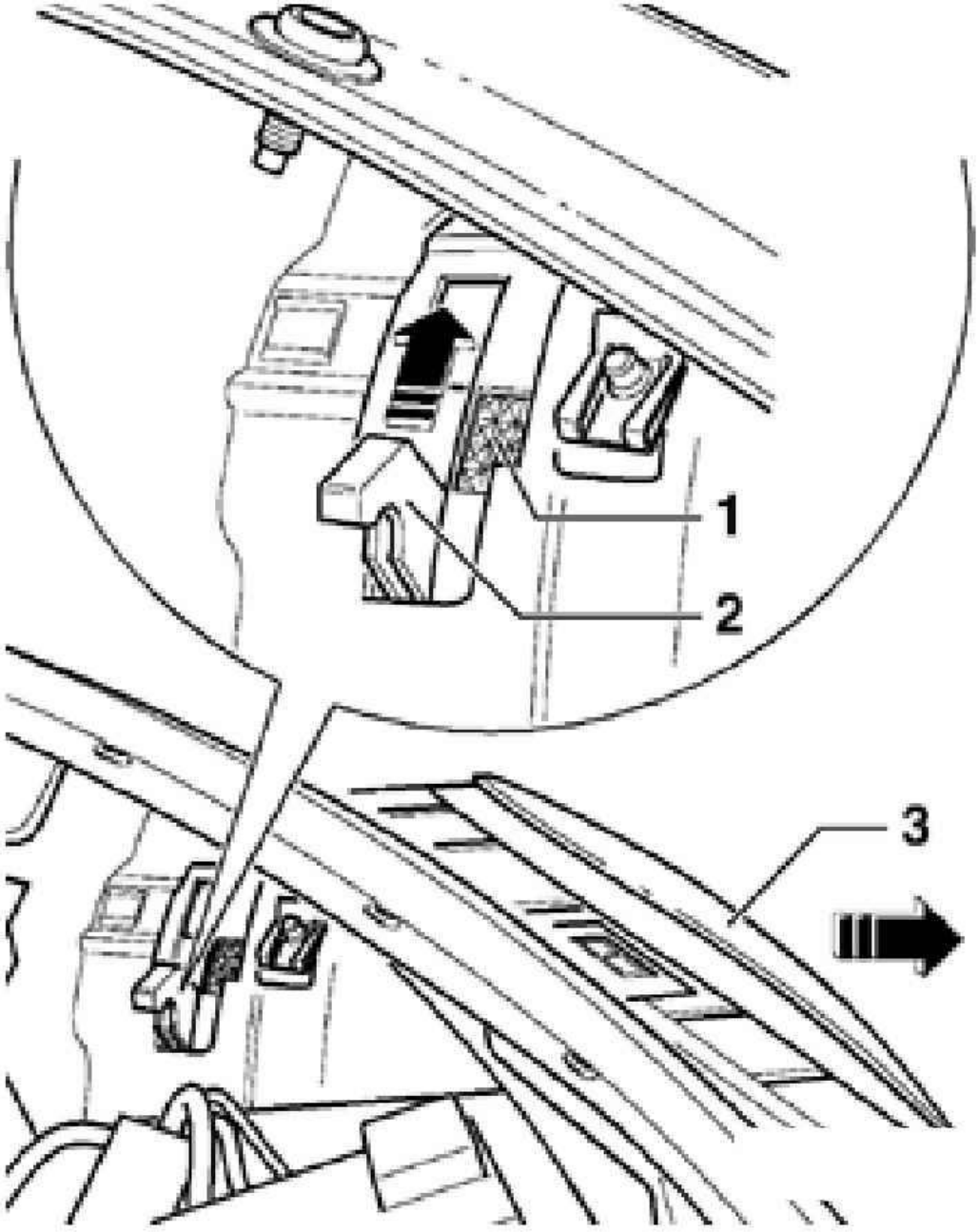

Fig. 40: V.A.G 1551 Scan Tool Display - Checking Catalyst (5 Of 6)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Maintain engine speed at 1800 to 2200 RPM until catalyst temperature in display zone 2 increases to above 440° C.

If the diagnostic is initiated from engine control module the display in display zone 4 jumps from "Test OFF" to "Test ON."

- Check catalyst conversion (amplitude condition) in display zone 3:

  Specification: max. 0.20

- Continue to maintain speed at 1800 to 2200 RPM until the specification "Cat B1 OK." appears in display zone 4.

NOTE: This process can take a few minutes. If no result is displayed within 15 seconds, change RPMs within specified range.

DISPLAY ZONES

	Display zones			
	1	2	3	4
Display group 46: Catalyst diagnostic Bank 1				
Display	xxxx RPM	xxx.x °C	x.xx	Test OFF/Test ON Cat B1 OK. Cat B1 n. OK.
Indicated	Engine speed (in steps of 40)	Catalyst temperature	Catalyst conversion (amplitude condition)	Diagnosis condition and Diagnosis result
Working range	0 to 6800 RPM	-	0.00 to 1.00	-
Specified value	1800 to 2200 RPM	Min.440° C	Max. 020	**Cat B1 OK**

If the display does not indicate as described:

- Remove engine speed adjuster VAG1788/10 from accelerator pedal.
- Press --> key.
- Check DTC memory:

  See Diagnostic Trouble Code (DTC) Memory, Checking And Erasing .

- Read readiness code:

  See Readiness Code, Displaying .

If the DTC memory has been erased or the engine control module separated from permanent positive, the readiness code must be generated again.

See Readiness Code, Displaying .

If the display indicates as described:

- Remove engine speed adjuster VAG1788/10 from accelerator pedal.
- Press --> key.

Indicated on display:

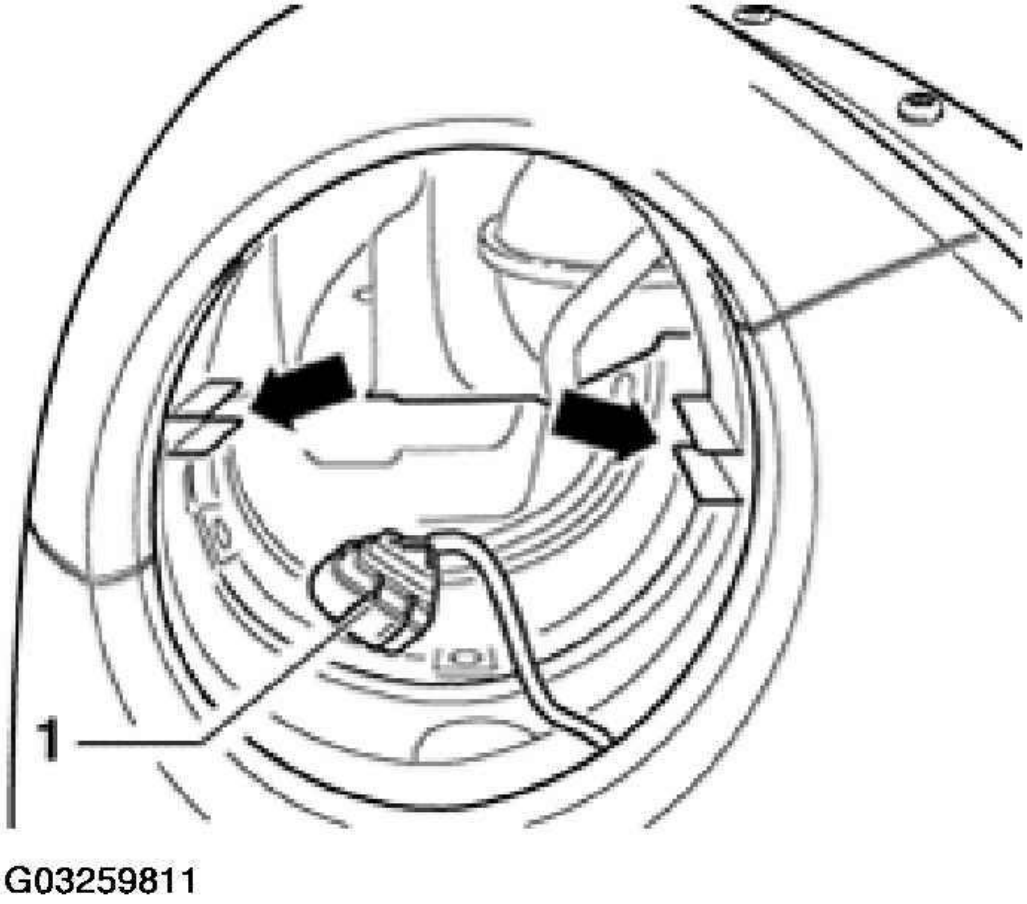

Fig. 41: V.A.G 1551 Scan Tool Display - Checking Catalyst (6 Of 6)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch ignition off.

SECONDARY AIR SYSTEM

WARNING: When doing any repair work, especially in the engine compartment, due to the cramped conditions, pay attention to the following:

- **Route all sorts of lines (e.g. for fuel, hydraulics, evaporative emissions system, coolant, refrigerant, brake fluid and vacuum lines and hoses) and electrical wiring so that the original positions are restored.**
- **Make sure sufficient clearance to all moving or hot components.**

Function

The secondary air system blows air in behind the exhaust valve for 100 seconds during a cold start (+5° C to +33° C coolant temperature). This produces an oxygen rich exhaust gas, causes afterburning and reduces the heating-up phase of the catalyst. Activation occurs from the Motronic control module (ECM) -J220- via the Secondary air injection (AIR) pump relay -J299- to secondary air inlet valve (-N112-, change-over valve) and combi-valve.

Additionally, after each subsequent engine start (up to max. 96° C engine temperature), the secondary air system will switch in for 10 seconds during idling and will be checked by the On Board Diagnostic (OBD). When this occurs, the oxygen sensor control must be active.

Secondary air system components, removing and installing

NOTE:

- **Components marked with an * are checked by the On Board Diagnostic (OBD).**

  See On Board Diagnostic (OBD) .

- **Components marked with ** are checked by the Output Diagnostic Test Mode (DTM).**

  See Output Diagnostic Test Mode (DTM) .

- **Secondary air injection pump relay -J299-**. See Secondary Air Injection (AIR) Pump Relay - J299**

NOTE: The following list refers to items in Fig. 42 .

1. **Gasket**
   - Replace
2. **Combi-valve**
   - Checking. See **COMBI-VALVE, CHECKING**

- Removing and installing. See **COMBI-VALVE, REMOVING AND INSTALLING**

3. **Connecting pipe/hose**
   - To distributor piece at vacuum reservoir on cylinder head cover
   - Check Turbocharging diagram:

     Engine code APH: See **TURBOCHARGING DIAGRAM** .

     Engine codes AWP, AWV: See **ENGINE CODES AWP, AWV** .

4. **Secondary air injection (AIR) solenoid valve -N112-*/****
   - Secured to bracket with 6 N.m
   - Bracket secured to cylinder head cover
   - Resistance: 21-24 ohms
   - Checking. See **SECONDARY AIR INJECTION (AIR) SOLENOID VALVE -N112-, CHECKING** .
5. **Connector**
   - Black, 2-pin
6. **O-Ring**
   - Replace
7. **Secondary air injection (AIR) pump relay -J299-*/****
   - In relay/fuse box (pushed into cable guide next to brake master cylinder). See **Secondary Air Injection (AIR) Pump Relay - J299**
8. **Pressure hose**
   - Ensure seated tightly
   - Press together at front to release
9. **10 N.m**
10. **Bracket**
11. **Retaining clip**
12. **Intake hose**
    - From upper air filter housing
    - Ensure seated tightly
    - Press together at front to release
13. **Secondary air injection (AIR) pump motor -V101-****
    - Checking. See **SECONDARY AIR INJECTION (AIR) PUMP MOTOR -V101-, CHECKING** .
14. **Bracket**
    - For secondary air injection pump motor
    - Secured to intake manifold
15. **25 N.m**
16. **Intake pipe**

17. **Cylinder head**
18. **10 N.m**

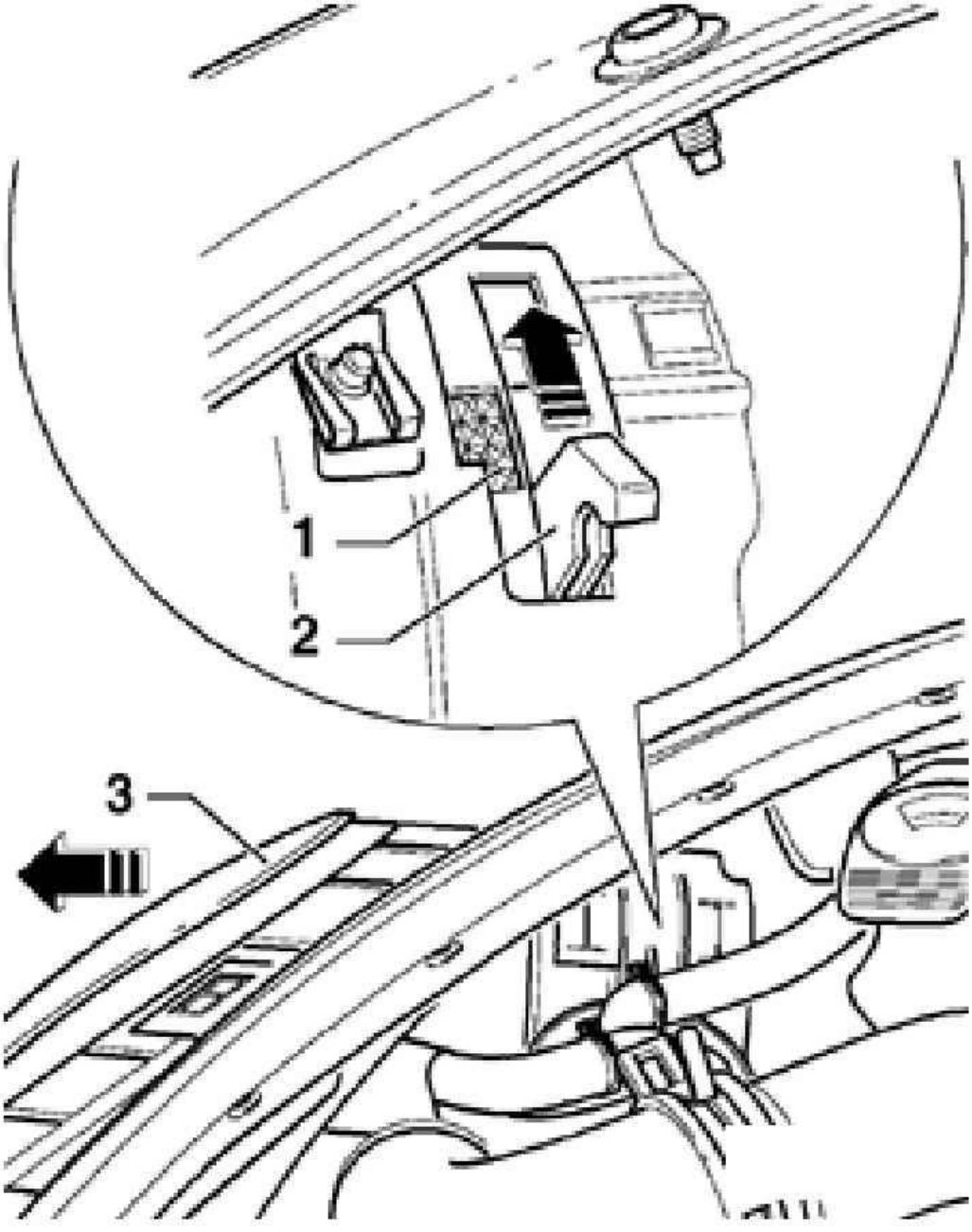

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Fig. 42: Removing And Installing Secondary Air System Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Secondary Air Injection (AIR) Pump Relay - J299

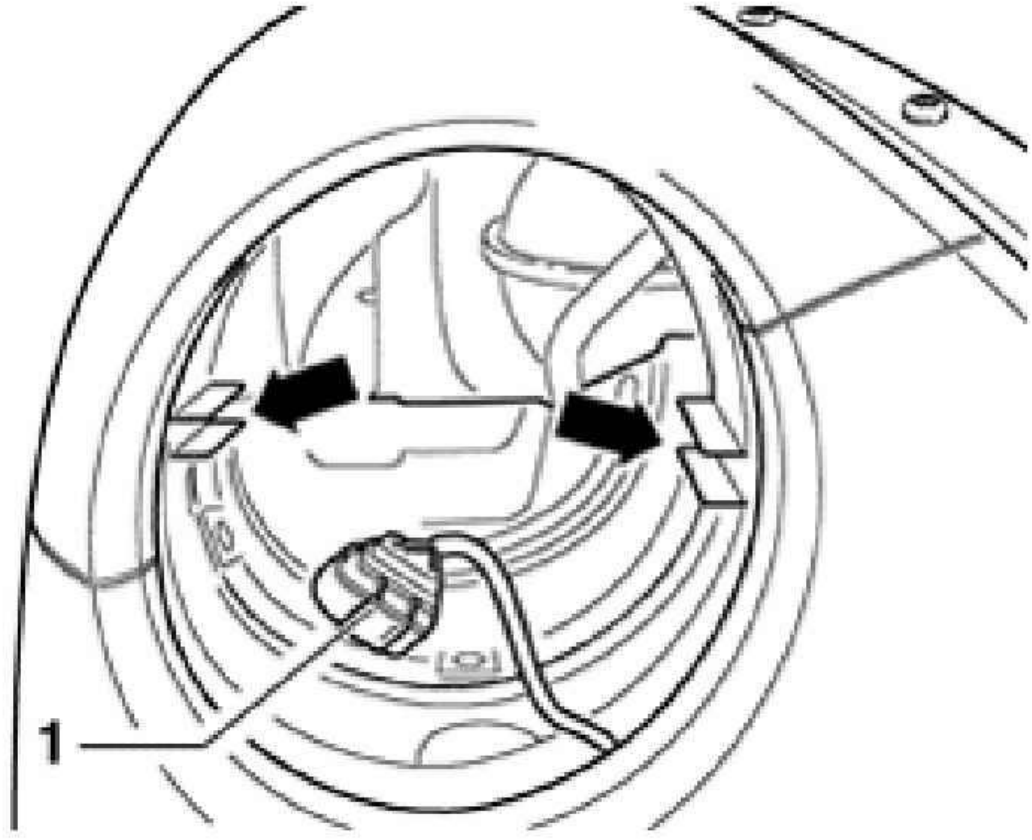

Fig. 43: Secondary Air Injection (AIR) Pump Relay - J299
Courtesy of VOLKSWAGEN OF AMERICA, INC.

NOTE:

- **If tools are necessary to remove relays or control modules from the relay plate, first disconnect battery Ground strap.**
- **Before disconnecting battery Ground strap obtain code for radios with anti-theft coding.**

Secondary air injection system, overview

Only engine code APH

For engine codes: AWP, AWV; Check Turbocharging diagram. See **ENGINE CODES AWP, AWV**

NOTE: The following list refers to items in Fig. 44 .

1. **Secondary air injection (AIR) solenoid valve -N112-*/****
2. **Vacuum reservoir**
3. **Recirculating valve for turbocharger -N249-**
4. **Non-return valve**
5. **Overrun shut-off valve**
6. **Brake servo**
7. **Air cleaner with Mass Air Flow (MAF) sensor -G70-**
8. **Secondary air injection (AIR) pump motor -V101-****
9. **Combination valve**
10. **Fuel pressure regulator**
11. **Intake pipe**

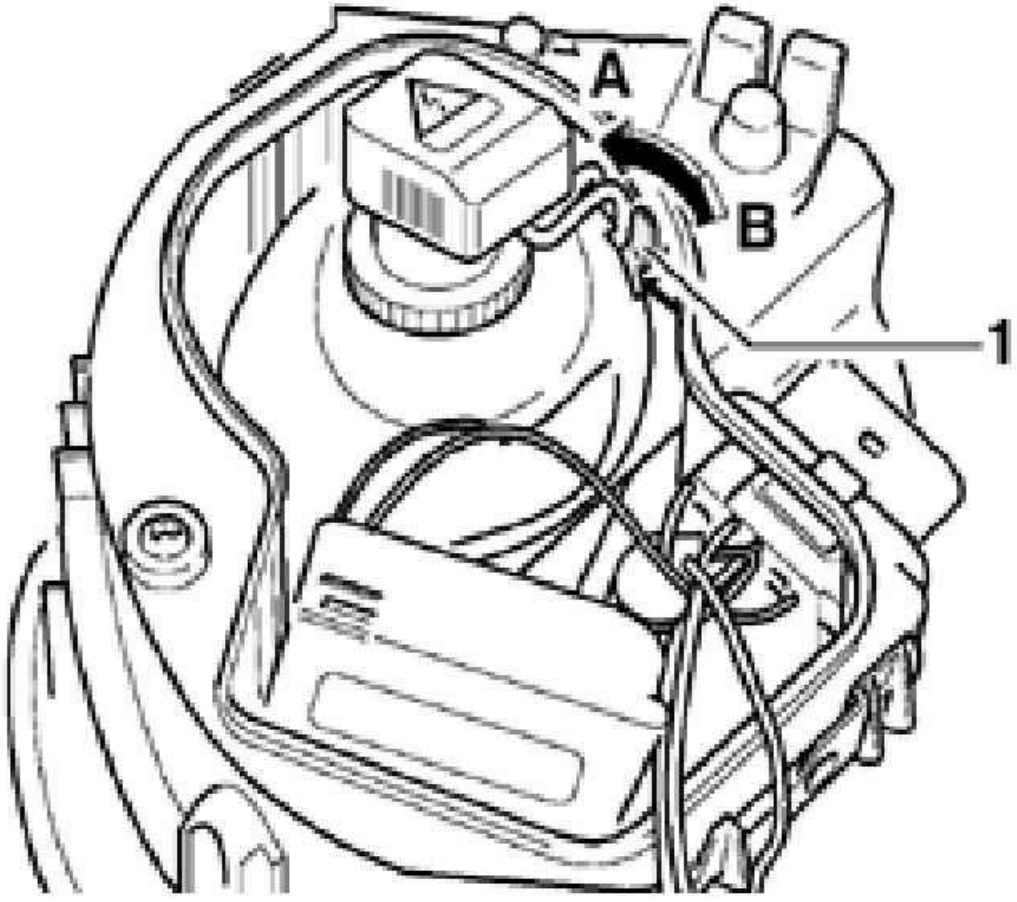

Fig. 44: Overview Of Secondary Air Injection System
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Combi-valve, checking

Special tools and equipment

- VAG1390 Hand vacuum pump

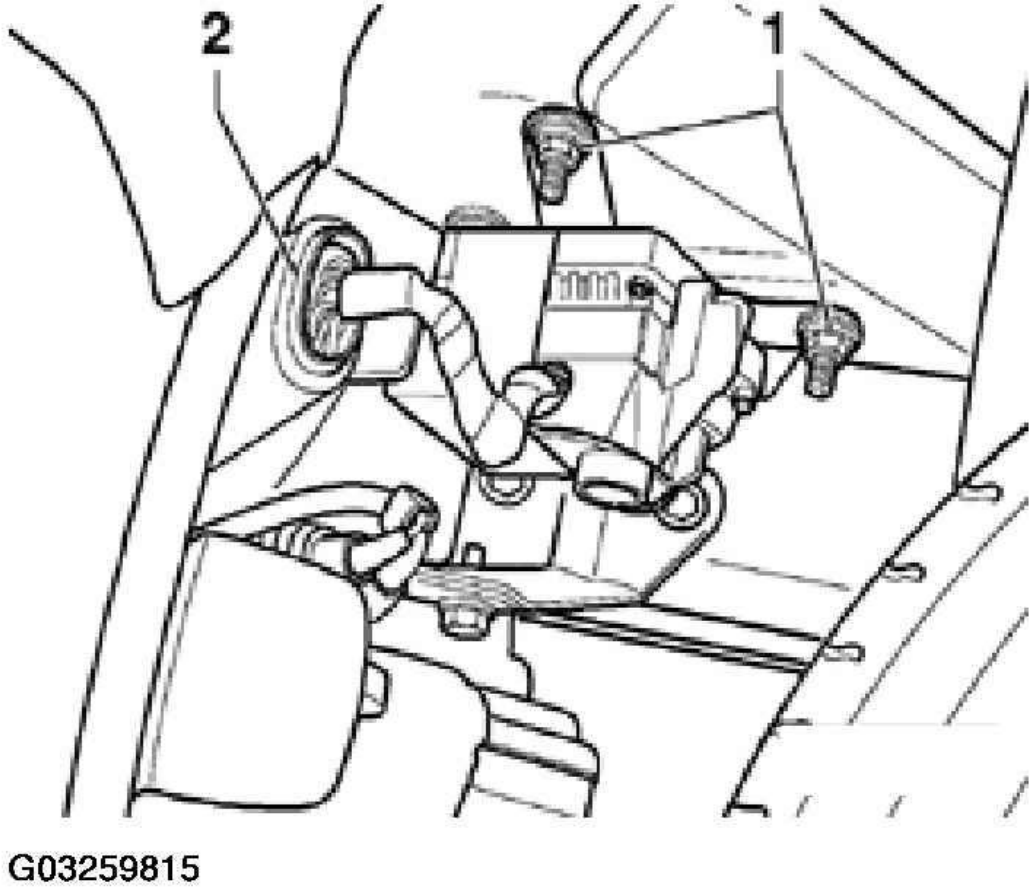

Fig. 45: Identifying VAG1390 Hand Vacuum Pump
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test conditions

- Output Diagnostic Test Mode (DTM) carried out

  See Output Diagnostic Test Mode (DTM) .

- Vacuum lines and hose connections free of leaks
- Vacuum lines not blocked/kinked

Test sequence

- Remove engine cover.
- Pull vacuum hose -1- off secondary air injection solenoid valve -2- -N112-.

- Connect hand vacuum pump VAG1390 to vacuum hose -1-.

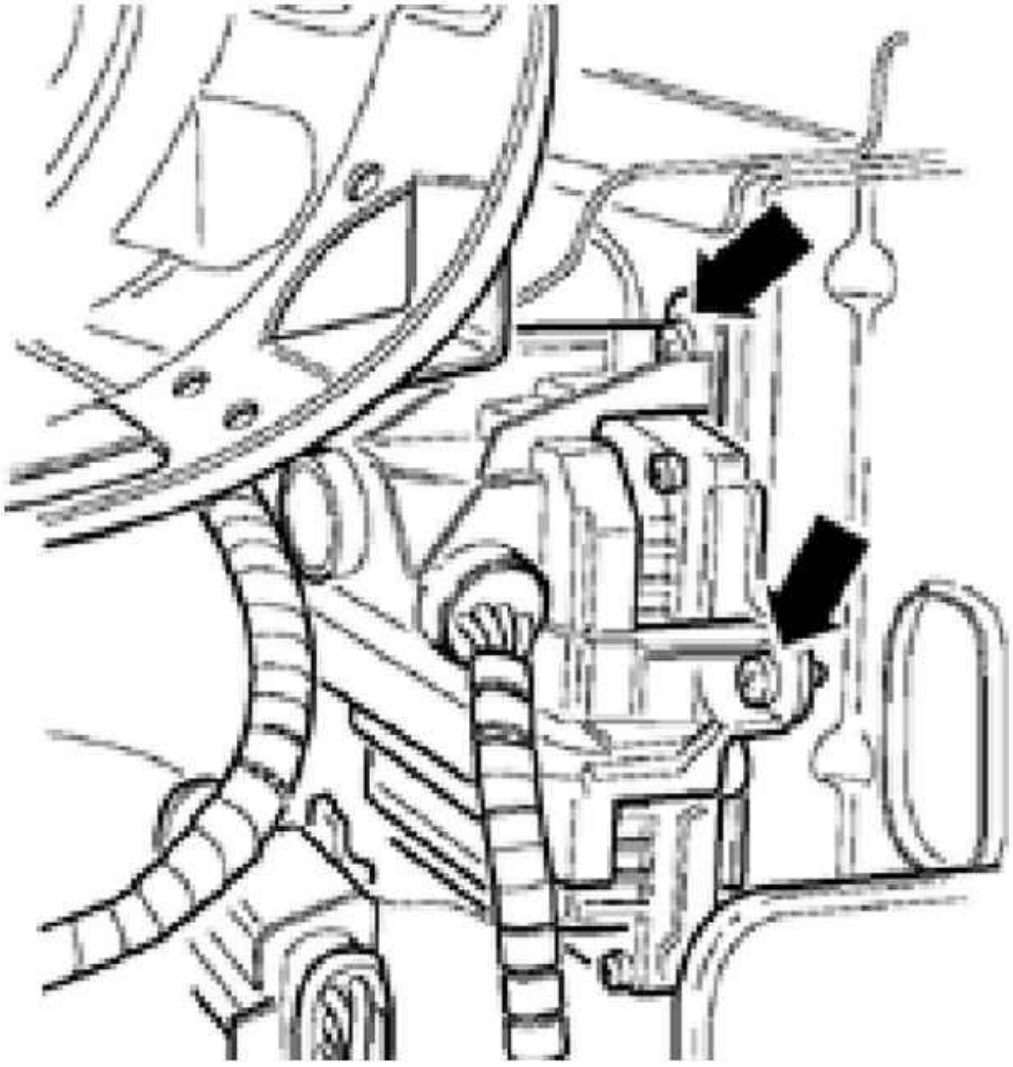

Fig. 46: Pulling Vacuum Hose Off Secondary Air Injection Solenoid Valve -N112-
Courtesy of VOLKSWAGEN OF AMERICA, INC.

NOTE: Do not use compressed air during the following check!

- Remove pressure hose -arrow- between secondary air pump motor and connecting pipe and blow in with

slight pressure.

Combi-valve must be closed.

NOTE: To release, press together the buttons on the hose coupling.

- Blow into pressure hose with light pressure -arrow-.

  Combi-valve must be closed.

- Operate hand vacuum pump.

  Combi-valve must open.

If the combi-valve does not open:

- Replace corresponding combi-valve. See **COMBI-VALVE, REMOVING AND INSTALLING** .

Secondary air injection (AIR) pump motor -V101-, checking

Only engine code APH

Engine codes AWP, AWV: See **ENGINE CODES AWP, AWV** .

Special tools and equipment

- VAG1527B Diode test lamp
- VAG1594A Adapter set
- VAG 1598/31 Test box

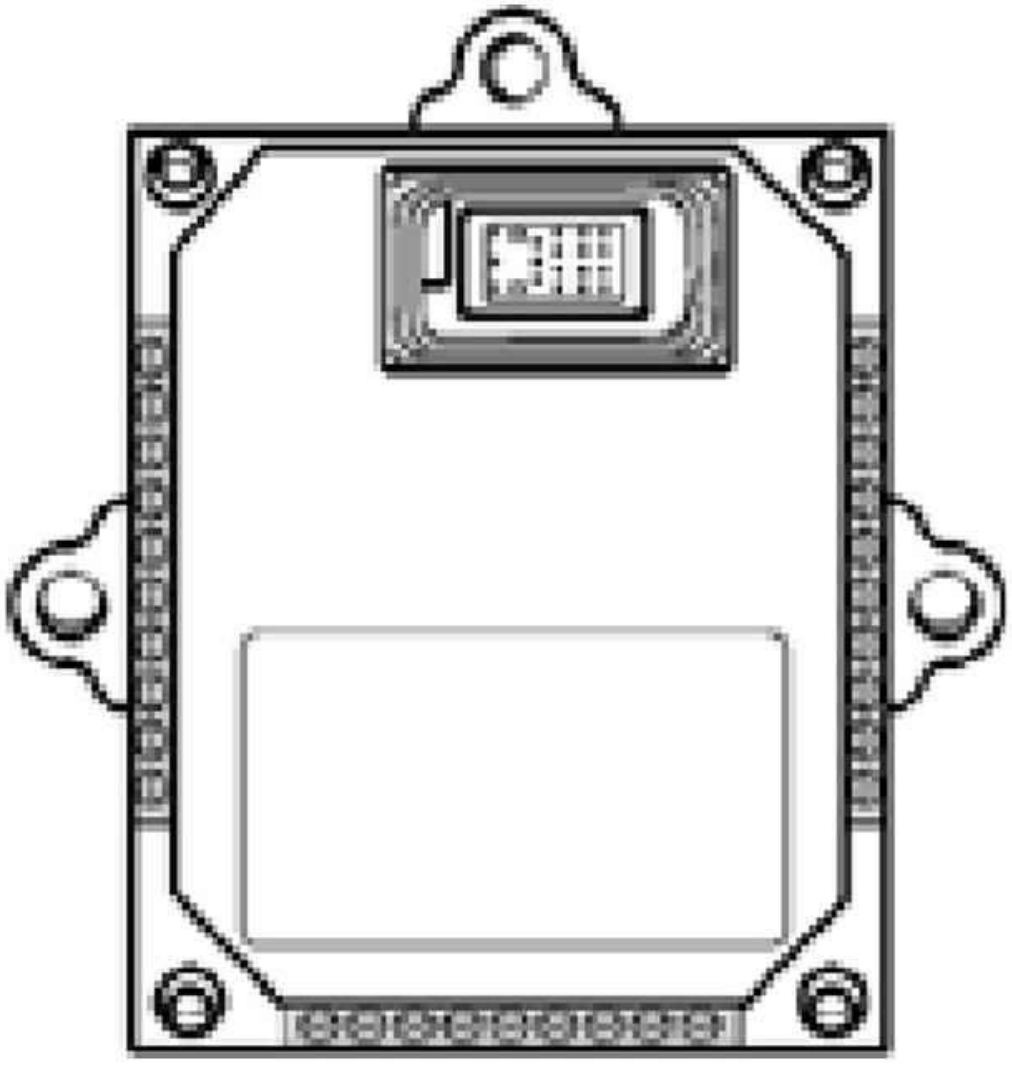

Fig. 47: Identifying Special Tools And Equipment
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test Conditions

- Main fuses must be OK

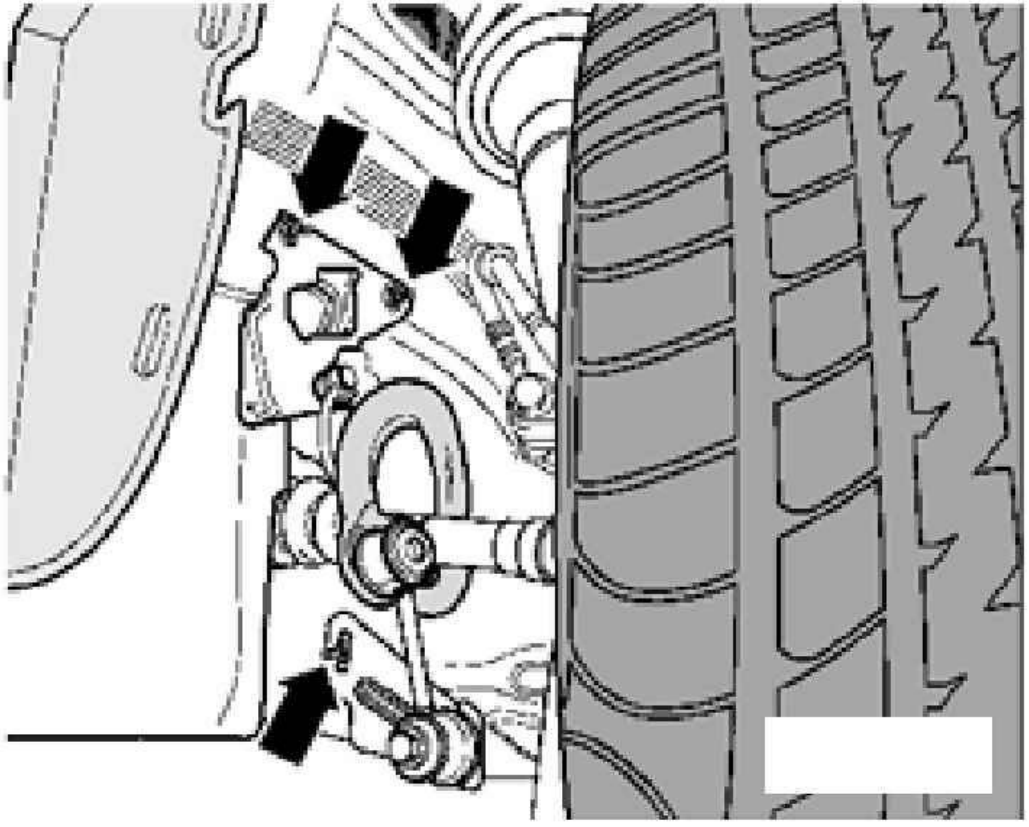

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Fig. 48: Identifying Main Fuses Location
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Battery voltage must be at least 11.5 V
- Output Diagnostic Test Mode (DTM) performed

  See Output Diagnostic Test Mode (DTM) .

Test sequence

- Remove engine cover.
- Remove pressure hose at motor for secondary air injection pump -arrow-.

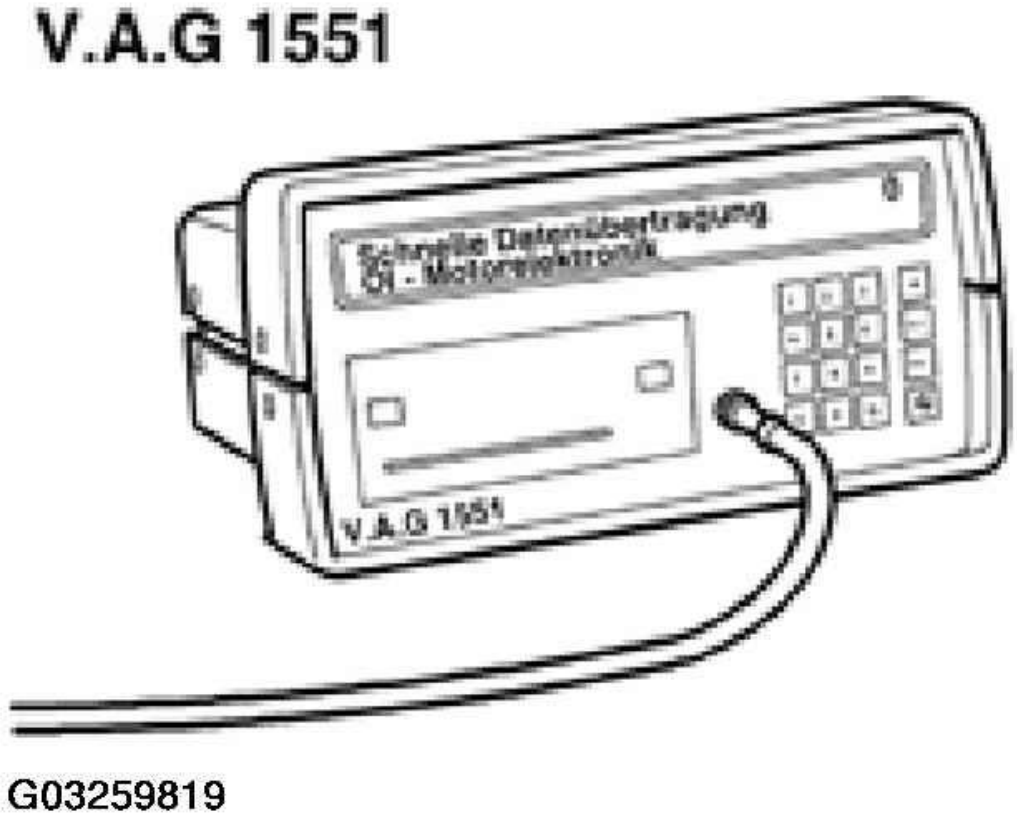

Fig. 49: Removing Pressure Hose At Motor For Secondary Air Injection Pump
Courtesy of VOLKSWAGEN OF AMERICA, INC.

NOTE: To release, press together the buttons on the hose coupling.

- Remove inner plenum chamber cover, left side.

  See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING** .

- Connect test box VAG1598/31 to control module wiring harness. The engine control module is not connected by this action.

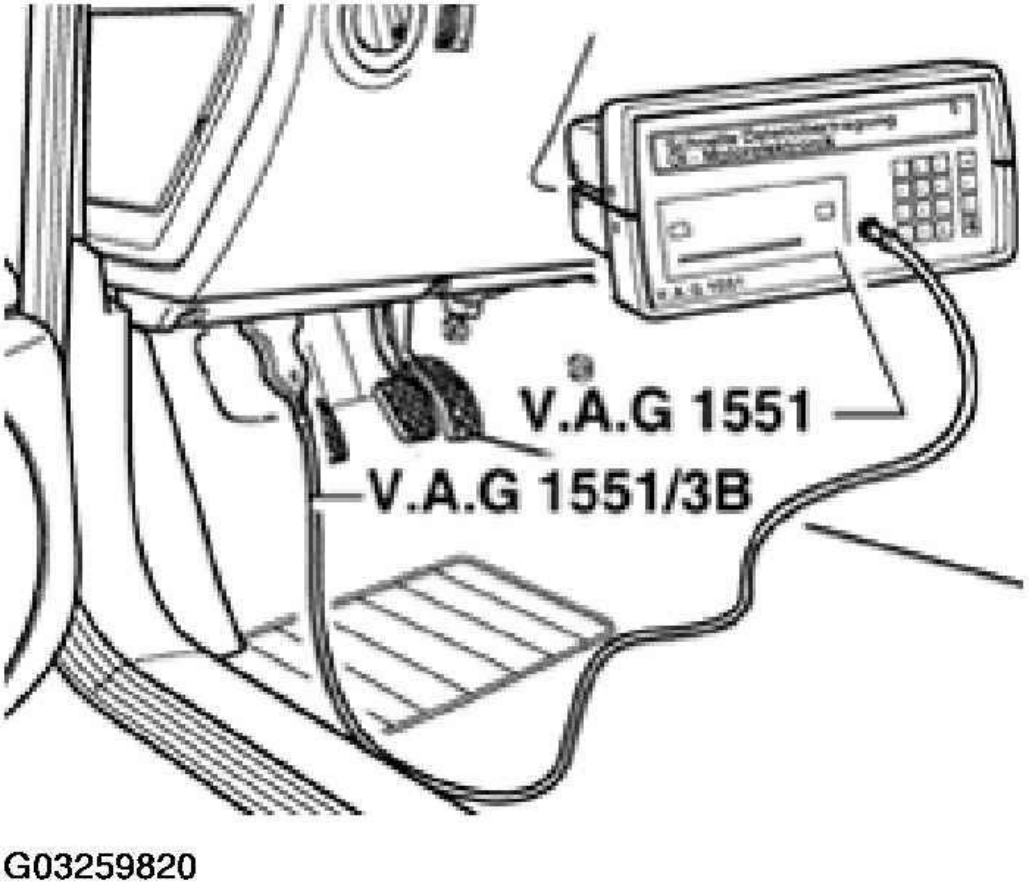

Fig. 50: Connecting Test Box VAG1598/31 To Control Module Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Switch ignition on.
- Bridge test box sockets 01 + 50 with aux. cables from VAG1594.

The secondary air injection pump motor must run and air must exit the connecting hose.

If the motor runs, but no air exits:

- Switch ignition off.
- Replace secondary air pump motor.

If the secondary air injection pump motor does not run:

- Pull 2-pin connector off secondary air injection pump motor -V101-.

- Connect diode test lamp VAG1527B to disconnected connector using aux. cables from VAG1594.

  LED must light up.

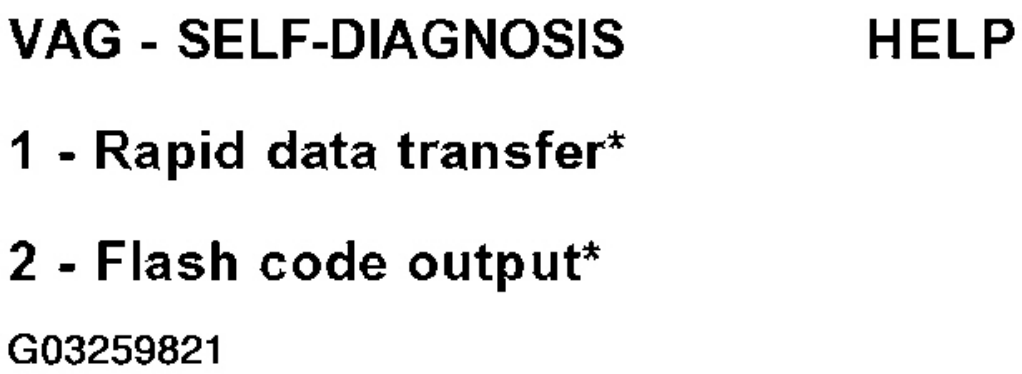

Fig. 51: Connecting Diode Test Lamp VAG1527B To Disconnected Secondary Air Injection Pump Motor Connector
Courtesy of VOLKSWAGEN OF AMERICA, INC.

If LED lights up (voltage supply OK):

- Switch ignition off.
- Replace secondary air pump motor.

If LED does not light up:

- Reconnect 2-pin connector.
- Initiate Output Diagnostic Test Mode (DTM) and activate EVAP canister purge regulator valve -N80-.

  See Output Diagnostic Test Mode (DTM) .

- Check DTC memory.

  See Diagnostic Trouble Code (DTC) Memory, Checking And Erasing .

- Read readiness code.

  See Readiness Code, Displaying .

If the DTC memory has been erased or the engine control module separated from the permanent positive, the

readiness code must be generated again.

See Readiness Code, Displaying .

Engine codes AWP, AWV

- V.A.G 1551 Scan Tool

NOTE: The vehicle system tester V.A.G 1552 can be used instead of the VAG 1551 scan tool, however a print-out is not possible.

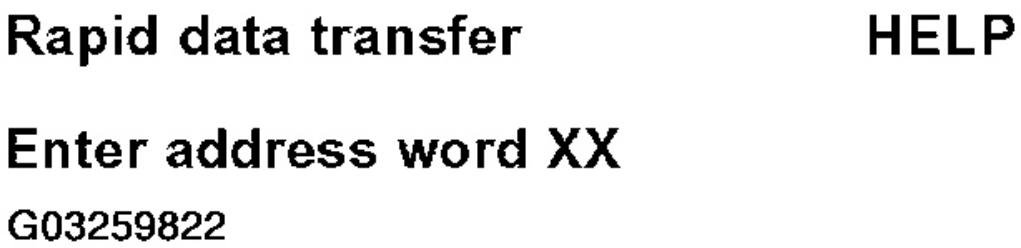

Fig. 52: Identifying V.A.G 1551 Scan Tool
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- V.A.G 1551/3B Cable

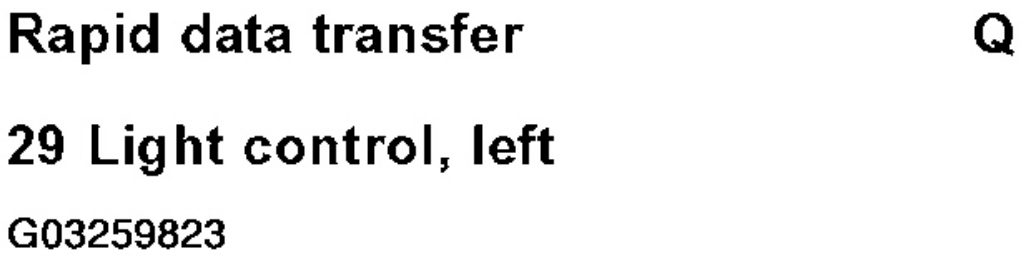

Fig. 53: Identifying V.A.G 1551/3B Cable
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test conditions

- Fuse for secondary air injection pump relay -J299- -arrow- located in the main fuse box on the battery is OK.

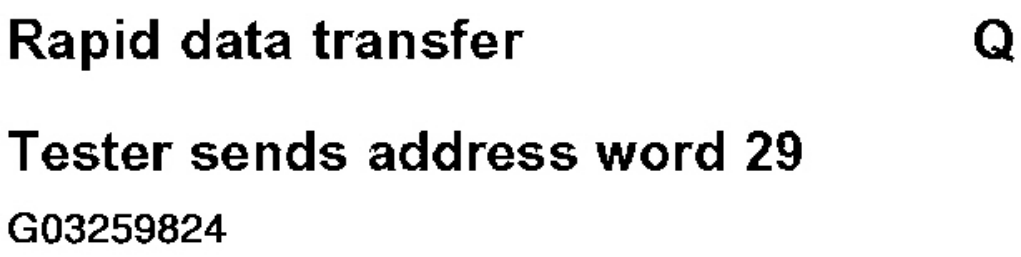

Fig. 54: Locating Fuse For Secondary Air Injection Pump Relay -J299
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- The battery voltage must be at least 11.5 V.
- The suction hose for secondary air pump is not blocked or kinked

Test sequence

- Remove engine cover.
- Disconnect pressure hose from secondary air injection pump motor.

NOTE: To release, press together the buttons on the hose coupling.

- Activate secondary air injection pump relay via Output Diagnostic Test Mode (DTM).

  See Output Diagnostic Test Mode (DTM) .

  Secondary air pump motor must run at intervals, and air must exit the outlet connections.

If the motor runs, but no air exits:

- Proceed with Output Diagnostic Test Mode (DTM) until completed.
- Press keys 0 and 6 for the function "End output" and confirm entry with Q key.
- Switch ignition off.
- Replace secondary air injection pump motor.
- Check DTC memory.

  See Diagnostic Trouble Code (DTC) Memory, Checking And Erasing .

- Read readiness code.

  See Readiness Code, Displaying .

If the DTC memory has been erased or the engine control module separated from the permanent positive, the readiness code must be generated again.

See Readiness Code, Displaying .

If the secondary air injection pump motor does not run at intervals:

- Check activation of secondary air injection pump motor:

  See Output Diagnostic Test Mode (DTM) .

Secondary air injection (AIR) solenoid valve -N112-, checking

Special tools and equipment

- Adapter set VAG1594

Fig. 55: Identifying Adapter Set VAG1594
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Diode test lamp VAG1527B

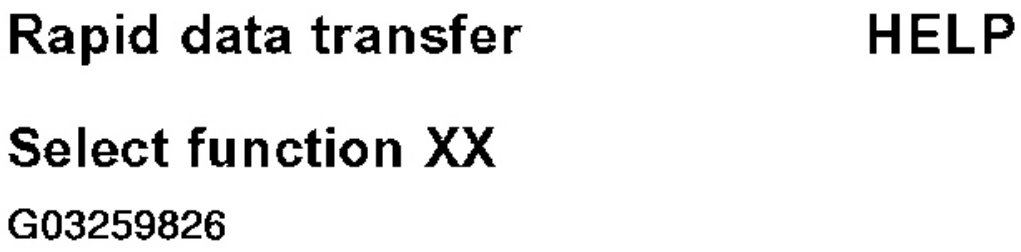

Fig. 56: Identifying Diode Test Lamp VAG1527B
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test conditions

- Engine oil temperature 5 to 33° C
- Secondary air injection pump motor OK

Test sequence

- Pull vacuum hose off combi-valve -arrow-.

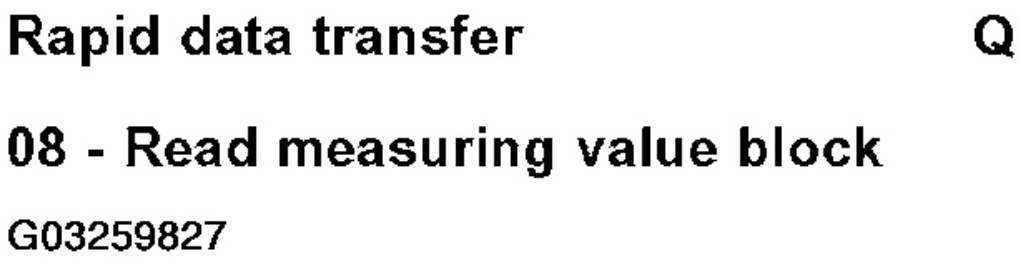

Fig. 57: Pulling Vacuum Hose Off Combi-Valve
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Start engine and run at idling speed.

When secondary air pump motor runs, vacuum must be perceptible at vacuum hose from secondary air injection solenoid valve.

If no intake manifold vacuum is perceptible:

- Switch ignition off.
- Check activation of AIR solenoid valve -N112-:

  See Output Diagnostic Test Mode (DTM) .

Combi-valve, removing and installing

Special tools and equipment

- VAG1331 Torque wrench (5 to 50 N.m)

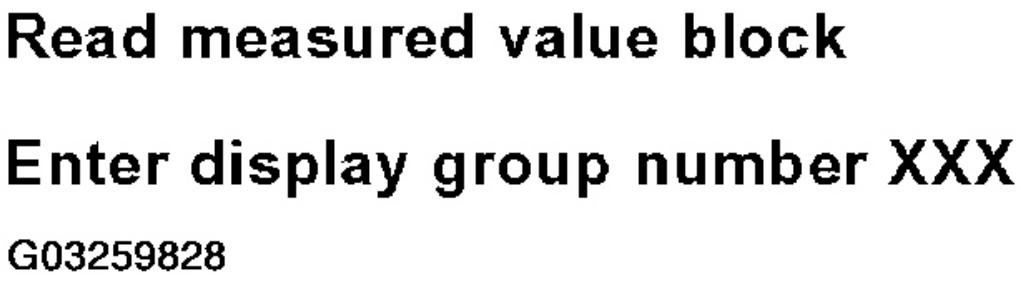

Fig. 58: Identifying VAG1331 Torque Wrench
Courtesy of VOLKSWAGEN OF AMERICA, INC.

NOTE: Always replace all gaskets and O-rings.

Removing

- Remove engine cover.
- Remove intake air hose.

  See Air Cleaner, Disassembling And Assembling .

- Remove pressure hose between combi-valve and secondary air pump at combi-valve.

  NOTE: To release, press together the buttons on the hose coupling.

- Pull vacuum hose off combi-valve.
- Unbolt combi-valve. For this, use flexible insert and 4 mm socket head from 3/8" socket set.

Installing

The rest of the assembly is basically a reverse of the disassembling sequence.

Tightening torques. See **SECONDARY AIR SYSTEM COMPONENTS, REMOVING AND INSTALLING** .

TURBOCHARGER, G-CHARGER

CHARGE AIR PRESSURE WITH TURBOCHARGER

Turbocharger system components, removing and installing

Observe rules for cleanliness. See **RULES FOR CLEANLINESS** .

NOTE:

- **All hose connections are secured with clips.**
- **Charge air pressure must be leak free.**
- **Replace self-locking nuts.**

NOTE: The following list refers to items in Fig. 1 .

1. **Exhaust manifold**
   - With turbocharger
   - Only replace as assembly
2. **Intake manifold**
3. **from charge air cooler**
4. **Gasket**
   - Replace
   - Coating (beading) toward intake manifold
5. **25 N.m (18 ft lb)**
6. **Gasket**
   - Note installation position
7. **Bracket**
   - For heat shield (item -9-)
8. **Washer**
9. **Heat shield**
   - Engage in bracket (item -7-)
10. **Turbocharger**
    - Only replace as assembly
    - Removing: remove right drive shaft at transmission:

      See **FRONT AXLE SHAFT** .

- Charge air pressure control, checking. See **CHARGE AIR PRESSURE SYSTEM, CHECKING** .

11. **Pressure unit**
    - For charge air pressure control valve
    - Integral part of turbocharger; cannot be replaced
12. **From Air Cleaner**
13. **Gasket**
    - Replace
14. **Sealing ring**
    - Replace
15. **Oil return pipe**
    - To cylinder block
16. **Banjo bolt**
    - 25 N.m (18 ft lb)
17. **15 N.m (11 ft lb)**
18. **40 N.m (30 ft lb)**
19. **Bracket**
20. **25 N.m (18 ft lb)**
21. **Gasket**
    - Replace
22. **Front exhaust pipe**
23. **Connection**
24. **10 N.m (7 ft lb)**
25. **Oil supply pipe**

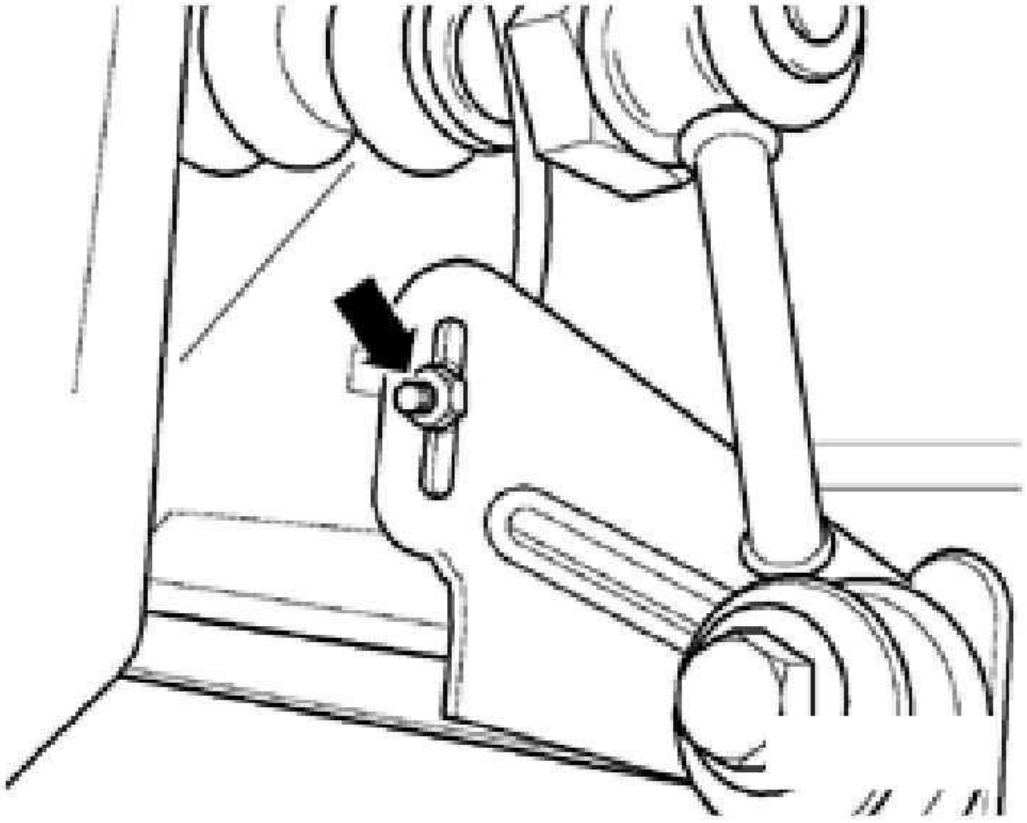

Fig. 1: Exploded View Of Turbocharger System Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Charge air cooler components, removing and installing

NOTE:

- **All hose connections are secured by clips.**
- **Charge air pressure must be free of leaks.**

NOTE: **The following list refers to items in Fig. 2 .**

1. **Charge air cooler**
2. **10 N.m (7 ft lb)**
3. **Connecting hose**
4. **Connecting pipe**

- Charge air cooler/intake manifold
- Lower pipe

5. **Connecting hose**
6. **Connecting pipe**
   - Charge air cooler/intake manifold
   - Upper pipe
7. **O-ring**
   - Replace if damaged
8. **Intake Air Temperature sensor -G72-**
9. **5 N.m (3.7 ft lb)**
10. **Connecting hose**
    - Charge air cooler/intake manifold
11. **Connecting hose**
    - Charge air cooler/turbocharger
12. **Charge air cooler**
13. **Bracket**

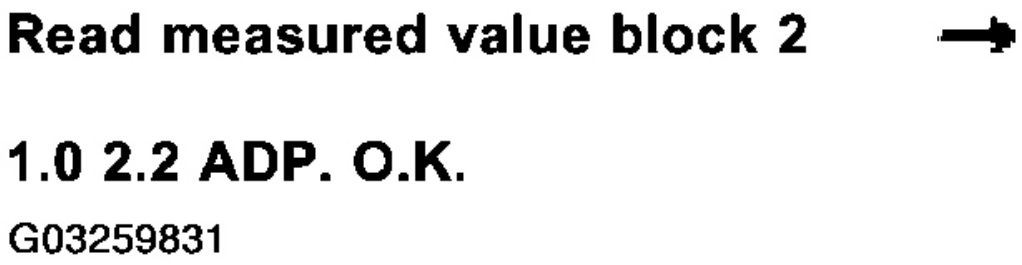

Fig. 2: Exploded View Of Charge Air Cooler Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Turbocharger, hose and pipe connections

Vacuum hose diagram

NOTE: The following list refers to items in Fig. 3 .

1. Solenoid valve for Wastegate Bypass regulator valve -N75-
2. to EGR vacuum regulator solenoid valve -N18-

3. to air filter
4. Vacuum reservoir
5. Reservoir for wastegate
6. Turbocharger
7. to Intake Manifold Change-over valve -N239-
8. Return valve, with connection points to Wastegate Bypass regulator valve -N75-.

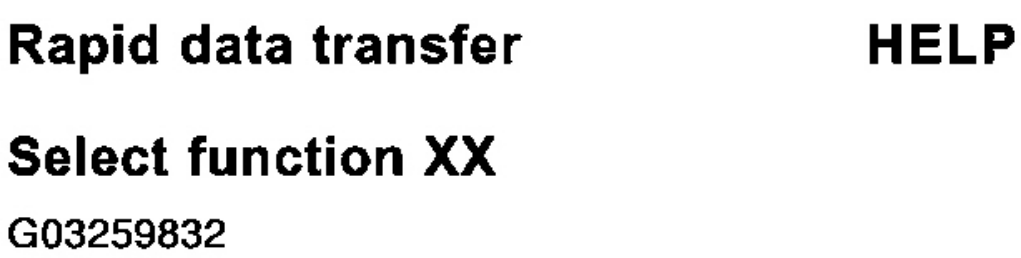

Fig. 3: Exploded View Of Turbocharger, Hose And Pipe Connections
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Rules for cleanliness

When working on the turbocharger and charge air pressure, pay careful attention to the following rules:

- Thoroughly clean all unions and the adjacent areas before disconnecting.
- Place parts that have been removed on a clean surface and cover over. Do not use fluffy cloths!
- Carefully cover opened components or seal, if the repair cannot be carried out immediately.
- Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored loose (e.g. in tool boxes etc.).
- When the system is open: Do not work with compressed air if it can be avoided. Do not move vehicle unless absolutely necessary.

CHARGE AIR PRESSURE SYSTEM, CHECKING

Special tools and equipment

- VAG 1390 Vacuum pump
- Fluke 83 Multimeter
- VW 1594 Adaptor kit
- VAG 1598/22 Test box

- VAG 1551/1552 with VAG 1551/3 adaptor cable
- Wiring diagram

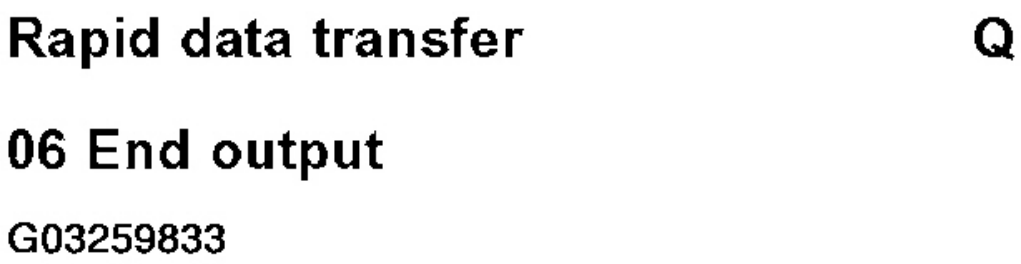

Fig. 4: Identifying Special Tools And Equipment
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Checking conditions

- No DTCs stored in Diagnostic Trouble Code memory

  See DTC Memory, Checking .

- No leaks from intake and exhaust systems.
- No stored DTCs from engine and fuel injection system, e.g. start of injection, fuel injectors and compression pressure.
- Engine oil temperature 80°C minimum.

Test sequence

Observe following if test and measuring instruments are required during a test drive:

- Test and measuring instruments must be secured to the rear seat and operated by a 2nd person from this location.

  CAUTION: If test and measuring instruments are operated from the front passenger seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat could receive serious injuries when the airbag is triggered.

- Connect VAG 1551/1552 Scan Tool

  See VAG1551/1552 Scan Tool, Connecting .

- Start engine and let idle
- Press 0 and 1 buttons to select Address word 01 "Engine electronics"

Display will appear as shown in **Fig. 5** .

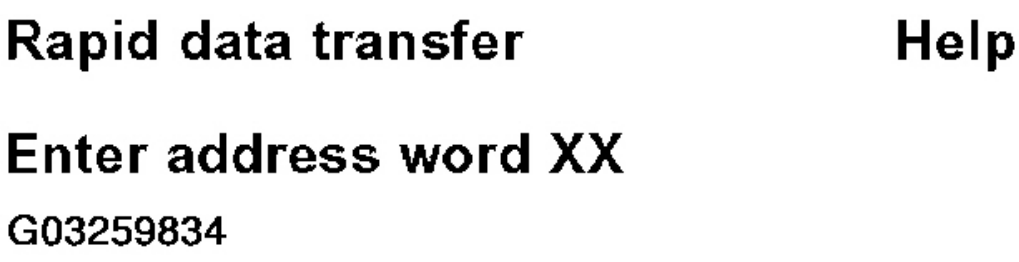

Fig. 5: Identifying VAG 1551/1552 Scan Tool Display (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press 0 and 8 buttons to select Function 08: "Read measuring value block"
- Press Q button to enter input

Display will appear as shown in **Fig. 6** .

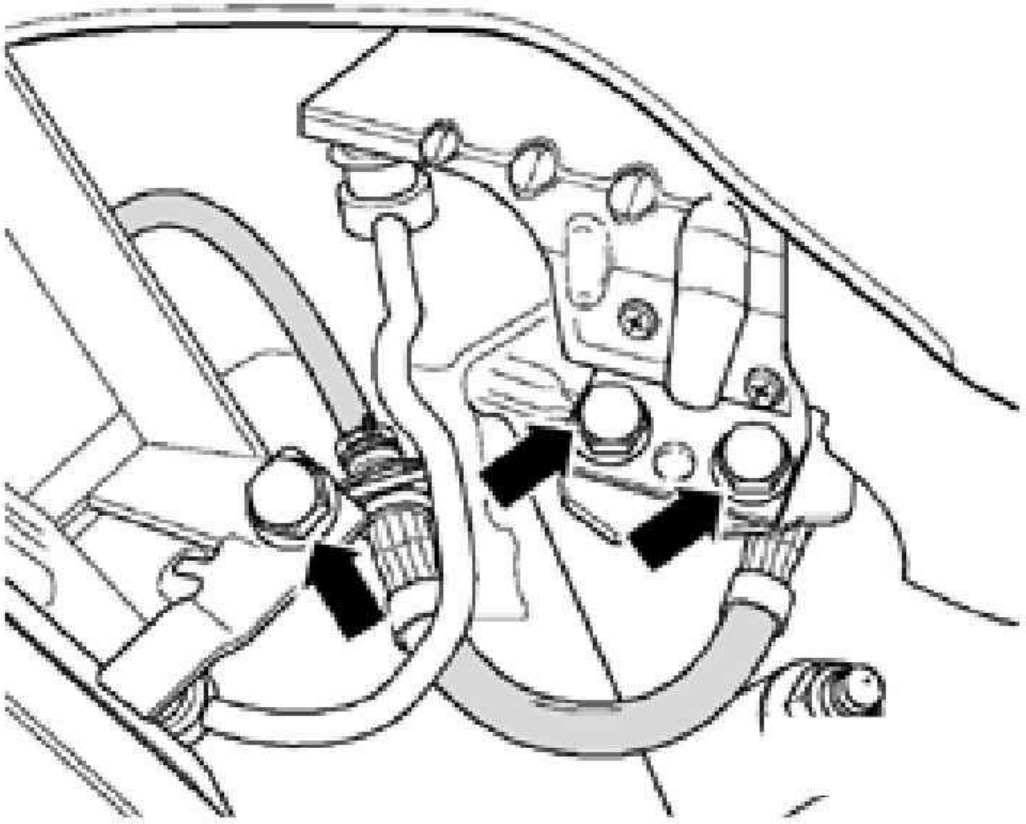

Fig. 6: Identifying VAG 1551/1552 Scan Tool Display (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press 0, 1 and 1 buttons to select Display Group 11
- Press Q button to enter input

  Read measuring value block 11 --> 840 RPM 938 mbar 978 mbar 92 %

Display will appear as shown

- Accelerate vehicle in 3rd gear from about 1500 RPM under Wide Open Throttle.
- Press VAG 1551 PRINT button at approx. 3000 RPM.

  Read measuring value block 11 --> 3090 RPM 1866 mbar 1917 mbar 62%

  Specification: 1700 to 2200 mbar (in display zone 3)

If specification not obtained:

- Perform Output Diagnostic Test Mode to activate Wastegate Bypass Regulator valve:

  See Function 03: Output Diagnostic Test Mode, Performing .

Display will appear as shown in **Fig. 7** .

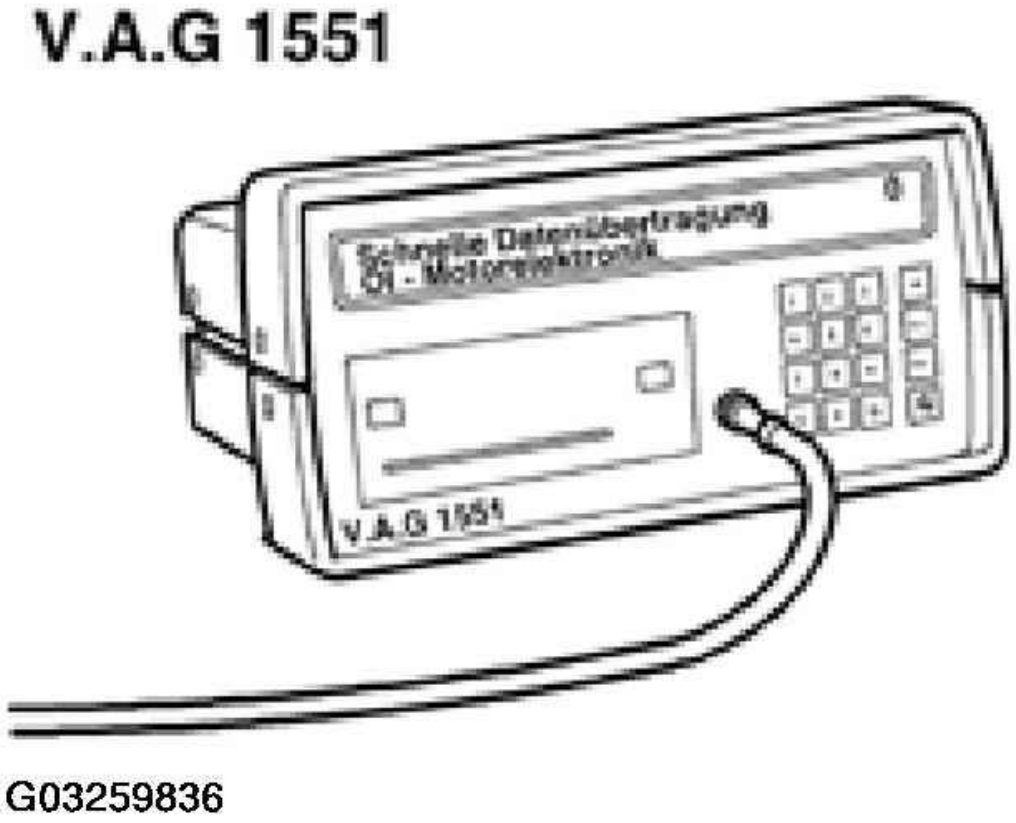

Fig. 7: Identifying VAG 1551/1552 Scan Tool Display (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

NOTE: The valve must function and the charge air pressure control rod must move back and forth (at least 3 to 4 times), as long as there is a vacuum in the vacuum reservoir.

If rod moves but pressure specifications are not obtained

- Replace turbocharger.

If rod does not move because solenoid valve is not working:

- Check Wastegate Bypass Regulator valve -N75-. See **WASTEGATE BYPASS REGULATOR VALVE -N75-, CHECKING** .
- Check vacuum hoses. See **TURBOCHARGER, HOSE AND PIPE CONNECTIONS** .

If rod does not move but solenoid operates:

- Connect VAG 1390 vacuum pump to Wastegate Bypass Regulator valve and check rod for ease of movement.

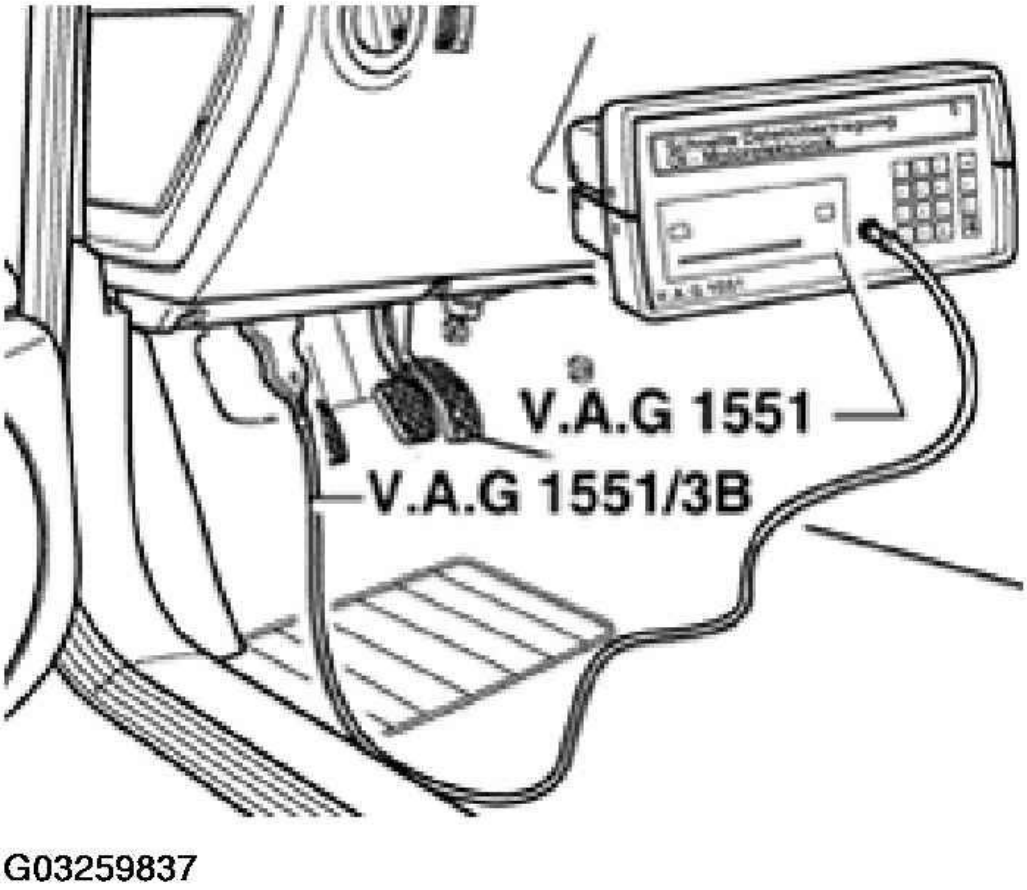

Fig. 8: Connecting Turbocharger To VAG 1390 Vacuum Pump
Courtesy of VOLKSWAGEN OF AMERICA, INC.

If rod does not move easily:

- Replace turbocharger assembly.

Wastegate Bypass Regulator valve -N75-, checking

- Switch ignition off.
- Disconnect Wastegate Bypass Regulator valve.
- Measure resistance between valve terminals.

Engine code ALH

Fig. 9: Measuring Resistance Between Wastegate Bypass Regulator Valve Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Specification: 14 to 20 ohms

If specification not obtained:

- Replace Wastegate Bypass Regulator valve -N75-.

If specification obtained:

- Switch ignition on.
- Measure supply voltage at valve connector terminal 1 and at engine Ground.

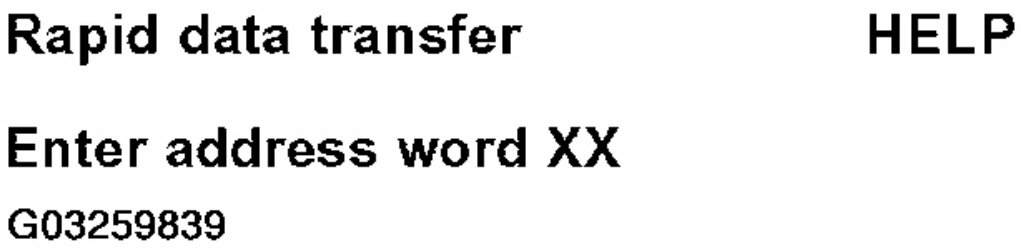

Fig. 10: Measuring Supply Voltage At Wastegate Bypass Regulator Valve Connector Terminal
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Specification: approx. battery voltage

If specification not obtained:

- Switch ignition off.
- Connect test box VAG 1598/22 to ECM wiring harness.

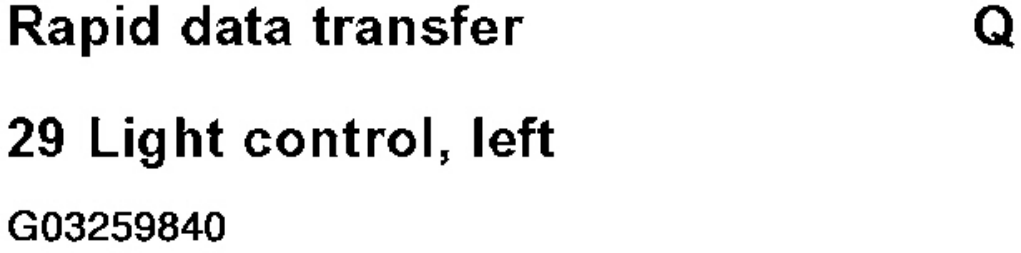

Fig. 11: Connecting Test Box VAG 1598/22 To ECM Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring for open circuit between Test Box and harness connector using Wiring diagram.

Up to MY 1999

- Terminal 1 + sockets 2 + 28
- Terminal 2 + socket 15

From MY 2000

- Terminal 1 + sockets 1 + 2
- Terminal 2 + socket 62

Wire resistance: 1.5 ohms maximum

- Check wires for short to one another, to vehicle Ground and to battery Plus.

  Specification: "INFINITE"ohms

If wiring OK

- Replace Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) -J248-:

  See Engine Control Module (ECM), Replacing .

EXHAUST SYSTEM, EMISSION CONTROLS

EXHAUST SYSTEM COMPONENTS, REMOVING AND INSTALLING

NOTE:

- **Removing and installing exhaust manifold. See TURBOCHARGER SYSTEM COMPONENTS, REMOVING AND INSTALLING .**
- **After working on the exhaust system make sure that the system is not under stress, and that it has sufficient clearance from the bodywork. If necessary, loosen double and single clamps and align muffler and exhaust pipe so that sufficient clearance is maintained to the bodywork and the support rings are evenly loaded.**
- **Replace self-locking nuts.**

Front exhaust pipe and catalyst with attachments

NOTE: The following list refers to items in Fig. 12 .

1. **from turbocharger**
2. **Gasket**
   - Replace
3. **25 N.m (18 ft lb)**
4. **Catalyst**
5. **to central muffler**
6. **Mounting**
7. **25 N.m (18 ft lb)**

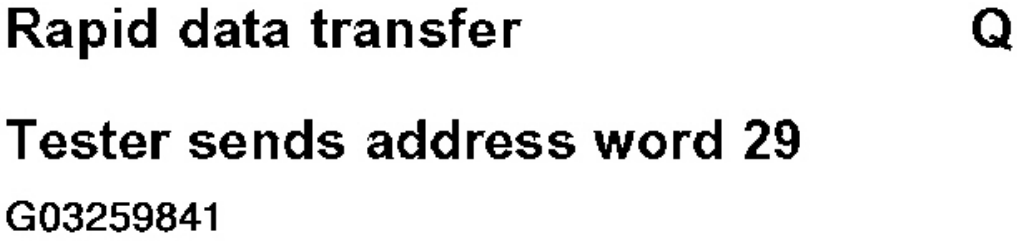

Fig. 12: Identifying Front Exhaust Pipe And Catalyst With Attachments
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Muffler with mountings

NOTE: The following list refers to items in Fig. 13 .

1. **40 N.m (30 ft lb)**
2. **from catalyst**
3. **Double clamp**
   - Note installation position. See **Double clamp installed position, checking**
4. **25 N.m (18 ft lb)**
5. **Mounting**
   - Note installation position. See **Installation position of mounting**
6. **Mounting**
   - With retaining ring
7. **Bracket**
8. **Mounting**
9. **Rear muffler**
   - Align rear muffler stress free. See **Rear muffler, aligning free of stress** .
10. **Separating point**
    - For repairs
    - Marked by three impressions on circumference of exhaust pipe
    - In production, exhaust pipe and rear mufflers are installed as a single component. For repairs, the exhaust pipe and rear muffler are supplied individually with a double clamp to allow connecting together.
    - Cut through connecting pipe at right angle to separation point. See **Exhaust pipe, separation point** .
11. **20 N.m (15 ft lb)**

12. **Tunnel bridge**

Fig. 13: Identifying Muffler With Mountings
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Double clamp installed position, checking

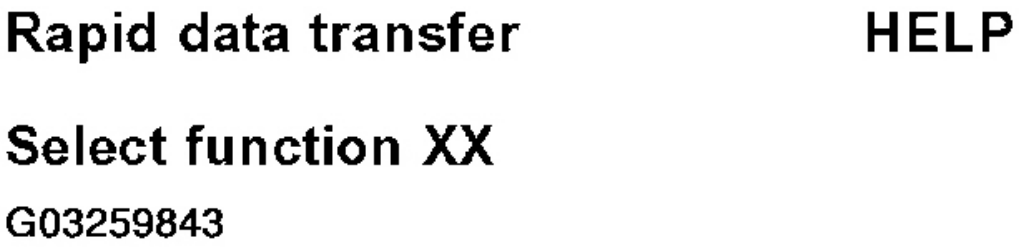

Fig. 14: Identifying Double Clamp Installed Position
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Position double clamp approx. 5 mm from mark A (arrow -1-).

NOTE: Mark -A- is valid for vehicles with either manual or automatic transmissions.

Installation position of mounting

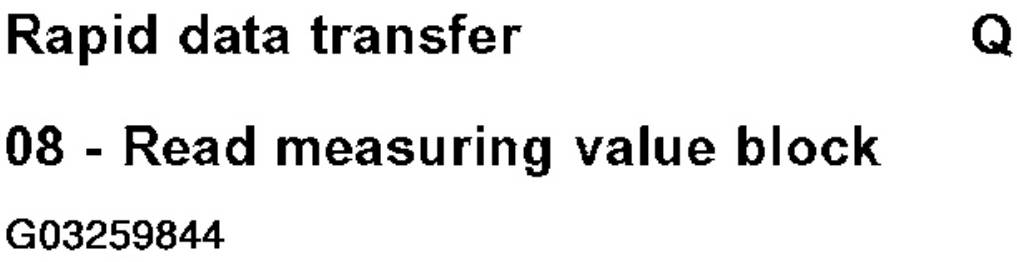

Fig. 15: Identifying Installation Position Of Mounting
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Angled side on foot of mounting (arrow) points forward.

Exhaust pipe, separation point

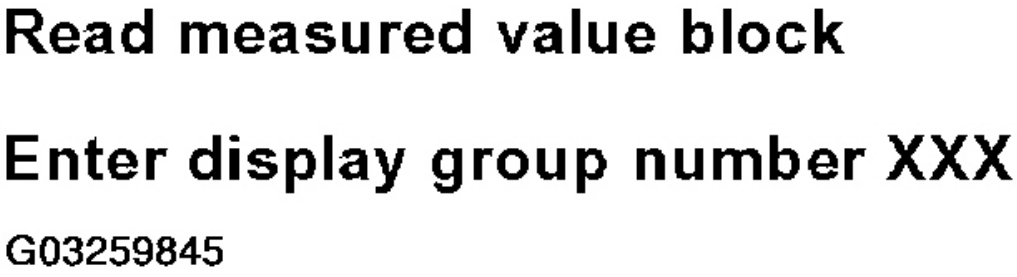

Fig. 16: Identifying Exhaust Pipe, Separation Point
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Cut exhaust pipe at right angles to separating point (arrow -2-).
- Position repair clamp -4- when installing (arrows -1- and -3-)
  - Tightening torque 40 N.m (30 ft lb)

Rear muffler, aligning free of stress

Read measuring value block 2 →

2.1 2.4 ADP. O.K.

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Fig. 17: Rear Muffler, Aligning Free Stress
Courtesy of VOLKSWAGEN OF AMERICA, INC.

NOTE: Mounting pins on exhaust pipe must run parallel with tunnel bridge (dimension -x- on left and right = the same).

EXHAUST GAS RECIRCULATION (EGR) SYSTEM, OVERVIEW

NOTE:

- **The function/control of the Exhaust Gas Recirculation (EGR) system is managed by the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) -J248- via the EGR Vacuum Regulator solenoid valve -N18-.**
- **The cone shaped plunger in the mechanical EGR valve ensures that various cross sectional openings are possible at different plunger heights.**
- **Every possible valve position is provided via pulsed control.**
- **Replace self-locking nuts.**

Exhaust Gas Recirculation (EGR) system components, removing and installing

NOTE: The following list refers to items in Fig. 18 .

1. **Intake manifold**
2. **O-ring**
   - Replace
3. **Throttle valve**
   - With EGR valve and control flap
4. **Exhaust Gas Recirculation (EGR) valve**
   - Component of intake support
   - Can only be replaced with intake support assembly
   - Checking: See **EXHAUST GAS RECIRCULATION (EGR) VALVE, CHECKING** .

- Control, checking:

See Function 03: Output Diagnostic Test Mode, Performing .

5. **10 N.m (7 ft lb)**
6. **from Air Cleaner**
7. **Gasket**
   - Replace
8. **25 N.m (18 ft lb)**
9. **Connecting pipe**
   - EGR cooler to intake support
10. **Connecting pipe**
    - EGR cooler to exhaust elbow
11. **Exhaust manifold**
12. **25 N.m (18 ft lb)**
13. **to heat exchanger**
14. **EGR cooler**
15. **Connection**
    - Heater
16. **to Coolant expansion tank**

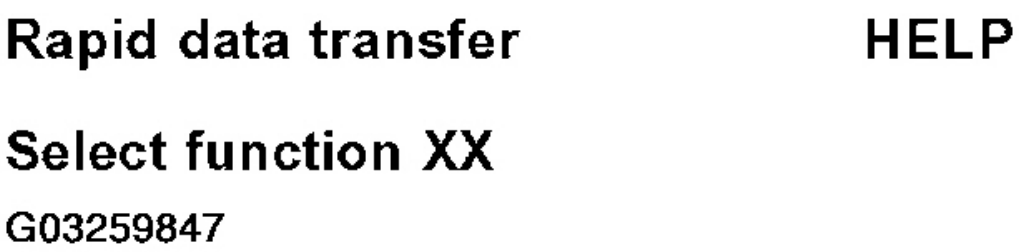

Fig. 18: Exploded View Of Exhaust Gas Recirculation (EGR) System Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Vacuum hose connections, diagram

NOTE: The following list refers to items in Fig. 19 .

1. **EGR valve**

2. **EGR Vacuum Regulator solenoid valve -N18-**
3. **Check valve**
4. **Brake servo**
5. **Air Cleaner**
6. **Vacuum pump**

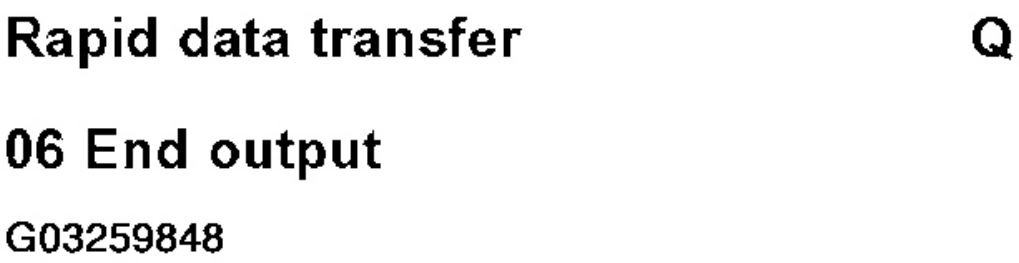

Fig. 19: Identifying Vacuum Hose Connections
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Exhaust Gas Recirculation (EGR) valve, checking

Special tools and equipment

- VAG 1390 Hand vacuum pump

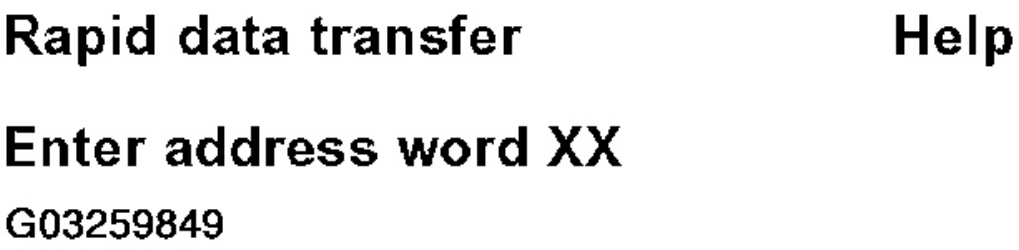

Fig. 20: Identifying VAG 1390 Hand Vacuum Pump
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test sequence

- Remove engine cover.
- Disconnect pipe between Charge Air cooler and intake manifold at intake manifold.
- Disconnect vacuum hose from EGR valve.
- Connect VAG 1390 hand vacuum pump to EGR valve.
- Operate pump and observe membrane rod.

Membrane rod must move in direction of arrow.

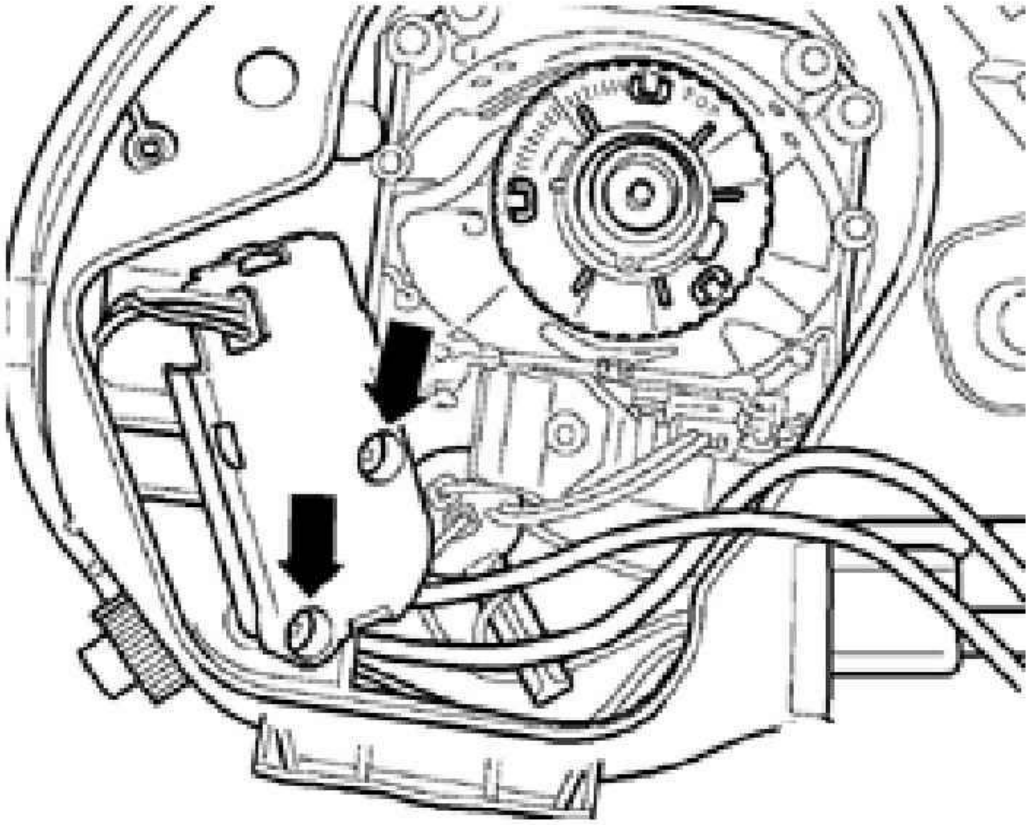

Fig. 21: Locating Hand Vacuum Pump Membrane Rod
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Disconnect hand vacuum pump hose from EGR valve.

Membrane rod must move back against direction of arrow to its original position.

Exhaust Gas Recirculation (EGR), checking

Special tools and equipment

- Fluke 83 multimeter
- VW 1594 Adaptor kit
- VAG 1598/22 Test Box
- VAG 1551/1552 Scan Tool with VAG 1551/3 adaptor cable
- Wiring diagram

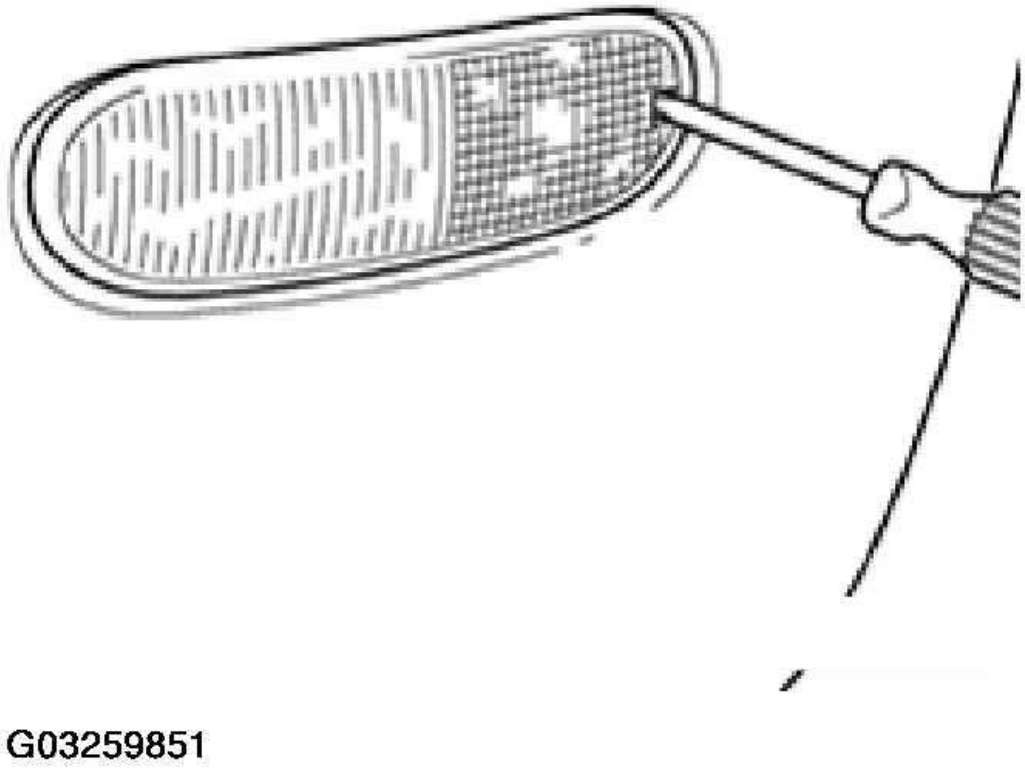

Fig. 22: Identifying Special Tools And Equipment
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test sequence

NOTE: The EGR return function is checked via Function 04 (Basic Setting). Through this procedure the valve for EGR is metered every 10 seconds, so that in measured value block 003 the extreme values for the EGR (air mass sensor) in

display field 3 can be read.

- Connect VAG 1551/1552 Scan Tool:

  See VAG1551/1552 Scan Tool, Connecting .

- Start engine and let idle.
- Press 0 and 1 buttons to select Address word 01 "Engine electronics":

  See DTC Memory, Checking .

Indicated on display

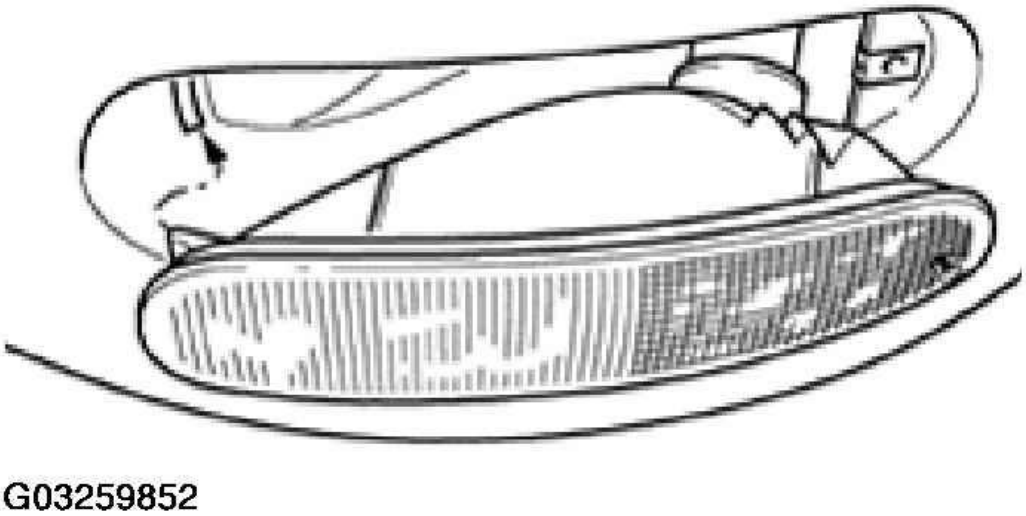

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Fig. 23: Identifying Special Tools Display (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press 0 and 4 buttons to select Function 04: "Basic setting".
- Press Q button to enter input.

Indicated on display

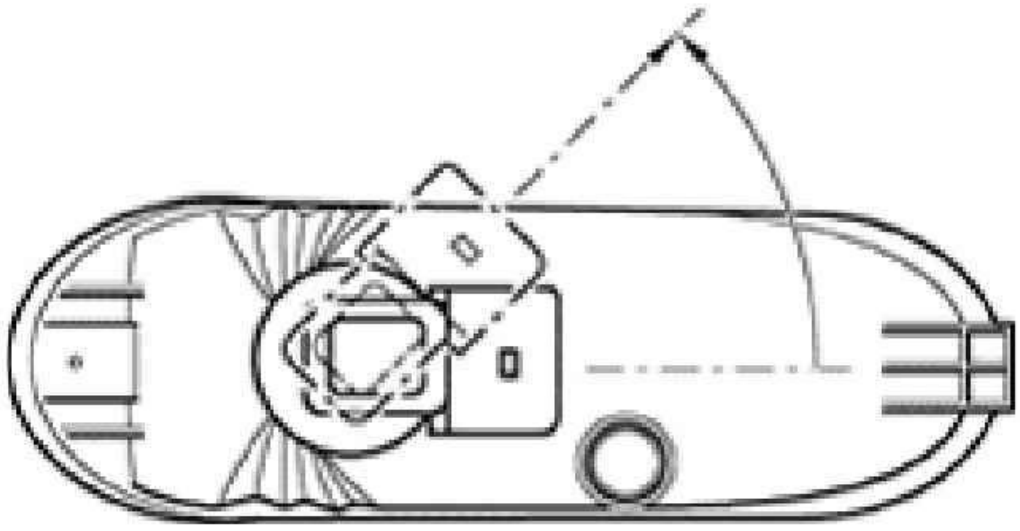

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Fig. 24: Identifying Special Tools Display (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press 0, 0 and 3 buttons to select "Display group 3".
- Press Q button to enter input.

Indicated on display: (1 to 4 - Display zones)

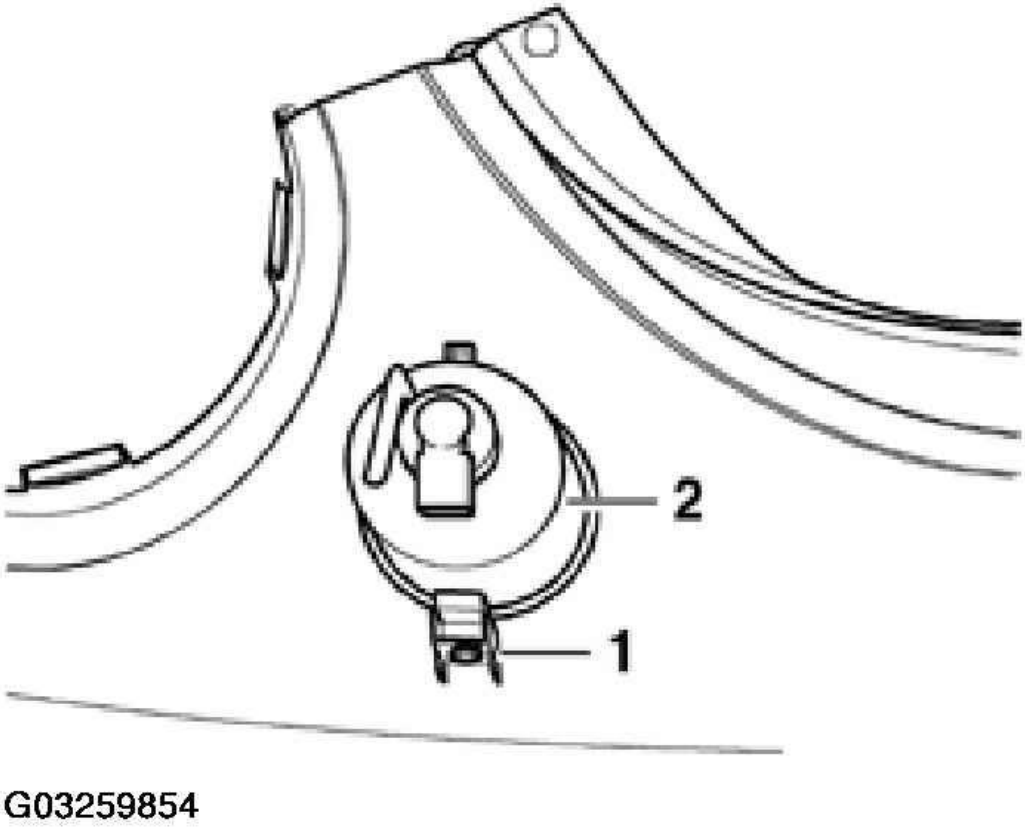

Fig. 25: Identifying Special Tools Display (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Display in field 2 must fluctuate every 10 seconds between EGR active or EGR inactive (n.aktiv).

Displays in display zones 3 and 4 must fluctuate within following control range:

NOTE: If a constant value of 550 mg/H is indicated in display zone 3, check Mass Air Flow sensor.

See Mass Air Flow (MAF) Sensor -G70-, Checking .

If EGR NOT active:

Specification display zone 3: 420 to 560 mg/stroke

Specification display zone 4: 0 to 5%

If EGR active:

Specification display zone 3: 170 to 340 mg/stroke

Specification display zone 4: 95 to 100%

If specifications not obtained:

- Check mechanical EGR valve. See **EXHAUST GAS RECIRCULATION (EGR) VALVE, CHECKING** .
- Check vacuum hoses. See **VACUUM HOSE CONNECTIONS, DIAGRAM** .
- Check EGR Vacuum Regulator solenoid valve as follows:
- Press --> button.
- Press 0 and 6 buttons to select Function 06: "End transfer"
- Press Q button to enter input.
- Switch ignition off.
- Disconnect harness connector -1- from EGR valve -2-.

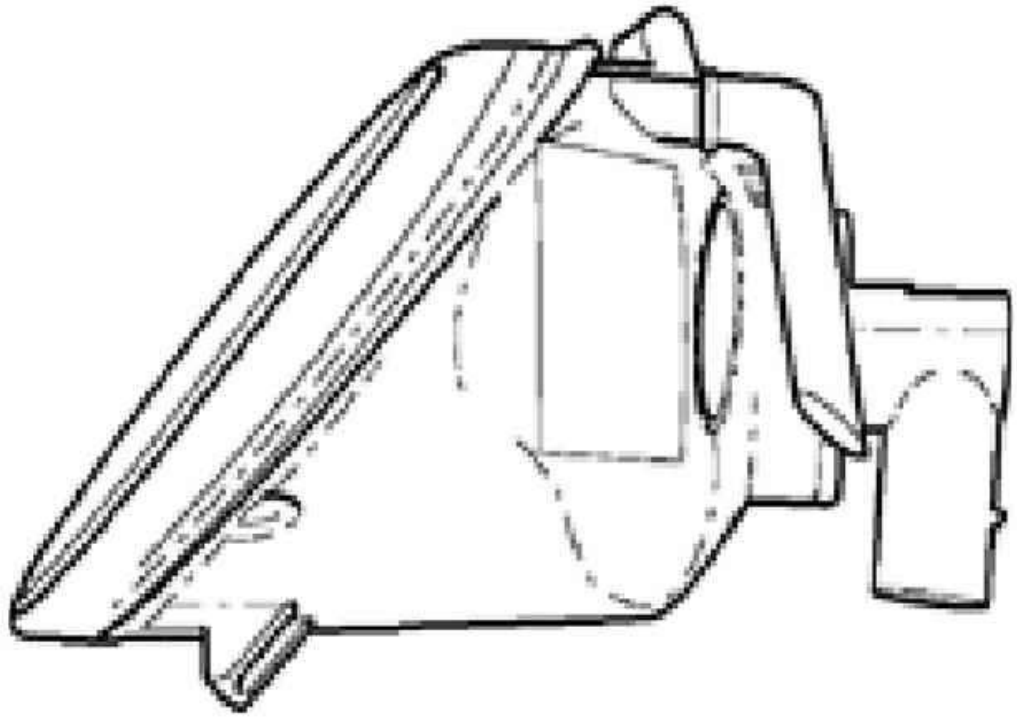

Fig. 26: Locating Harness Connector
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Measure resistance across valve.

  Specification: 14 to 20 ohms

If specification not obtained:

- Replace EGR Vacuum Regulator solenoid valve -N18-.

NOTE: At room temperature, resistance lies in the lower tolerance range and in the upper range at operating temperature.

If specification obtained:

- Switch ignition on.

- Measure supply voltage at valve connector terminal 1 and at engine Ground.

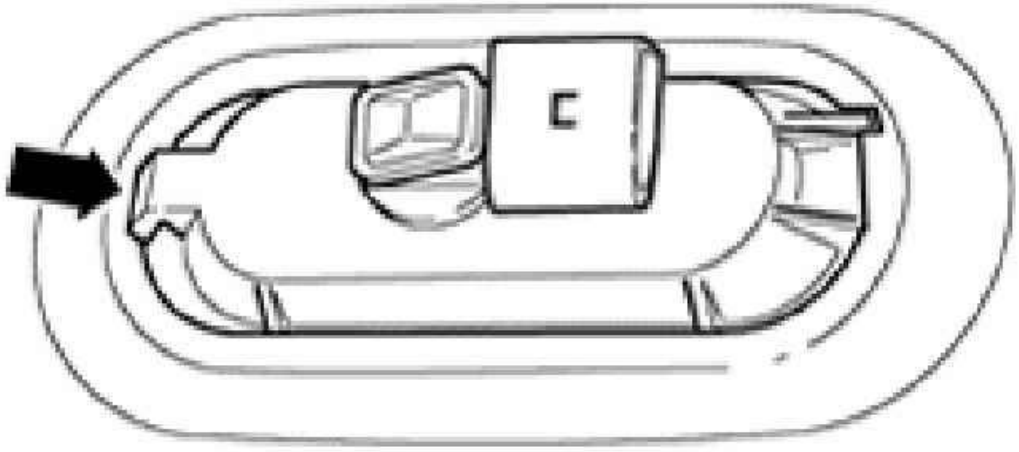

Fig. 27: Identifying EGr Vacuum Regulator Solenoid Valve Connector Terminal
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Specification: approx. battery voltage

If specification not obtained:

- Switch ignition off.
- Connect Test Box VAG 1598/22 to ECM wiring harness.

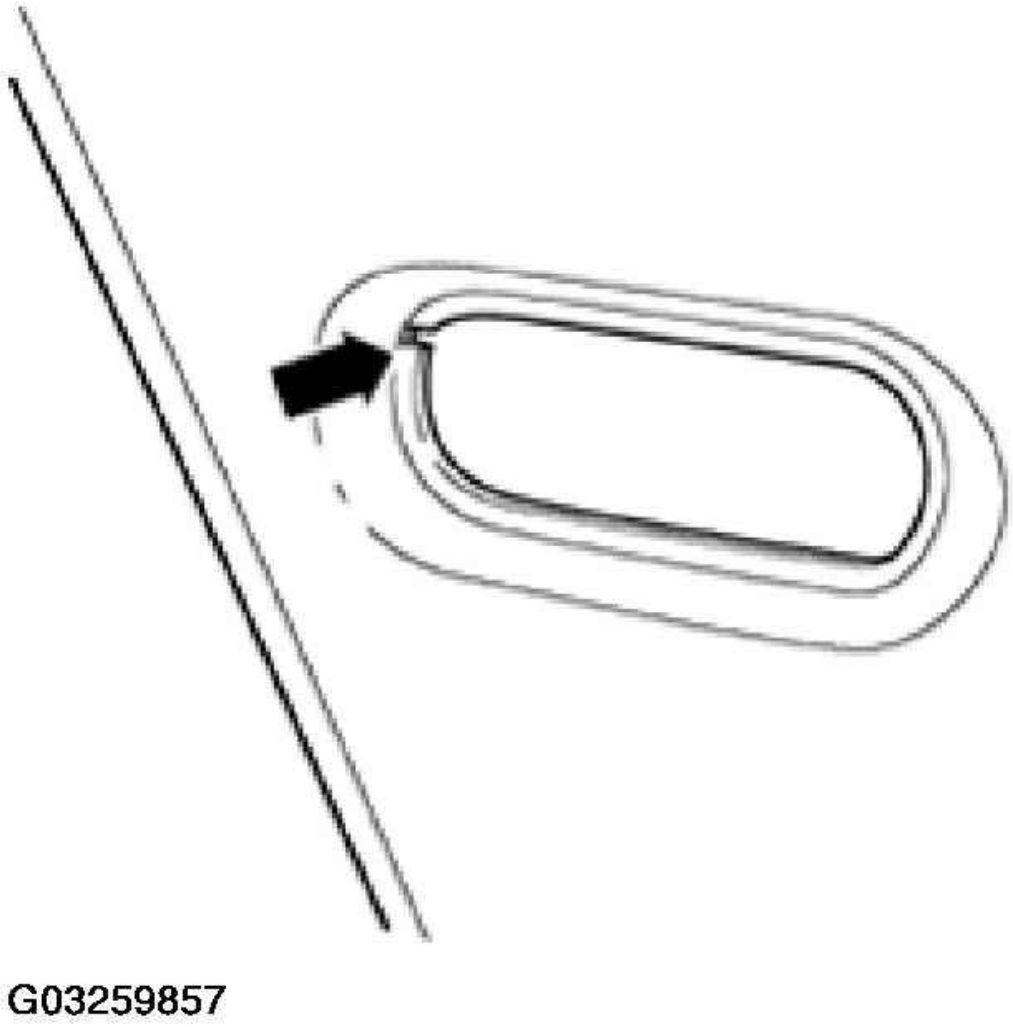

Fig. 28: Connecting Test Box VAG 1598/22 To ECM Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring for open circuit between Test Box and harness connector using wiring diagram.

Up to MY 1999

- Socket 1 + terminals 2 + 28
- Socket 2 + terminal 29

From MY 2000

- Socket 1 + terminals 1 + 2
- Socket 2 + terminal 61

Wire resistance: 1.5 ohms maximum

- Check wires for short to one another, to vehicle Ground and to battery Positive (+).

  Specification: "INFINITE" ohms

If wiring OK:

- Replace Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) -J248:

  See Engine Control Module (ECM), Replacing .

EXHAUST SYSTEM COMPONENTS, REMOVING AND INSTALLING

NOTE:

- **Removing and installing exhaust manifold. See TURBOCHARGER SYSTEM COMPONENTS, REMOVING AND INSTALLING .**
- **After working on the exhaust system make sure that the system is not under stress, and that there is sufficient clearance from the bodywork. If necessary, loosen double and single clamps and align muffler and exhaust pipe so that sufficient clearance is maintained to the bodywork and the support rings are evenly loaded.**
- **Replace self-locking nuts.**

FRONT EXHAUST PIPE AND CATALYST WITH COMPONENTS

NOTE: The following list refers to items in Fig. 1 .

1. **From turbocharger**
2. **Seal**
   - Always replace
3. **25 N.m**
   - Always replace
   - Oil threaded studs with G 052 112 A3
4. **Front exhaust pipe with catalytic converter**
5. **To rear muffler**
6. **Connector**
   - Connection in protective housing, on vehicle underside right side
7. **Mounting**
8. **25 N.m**
9. **Heated Oxygen Sensor (HO2S) -G39-, 50 N.m**
   - Grease only threads with hot bolt paste G 052 112 A3 (anti-seize compound). Grease must not get into slots on sensor body
   - Remove and install with 3337
   - To remove, separate connection and move wiring aside

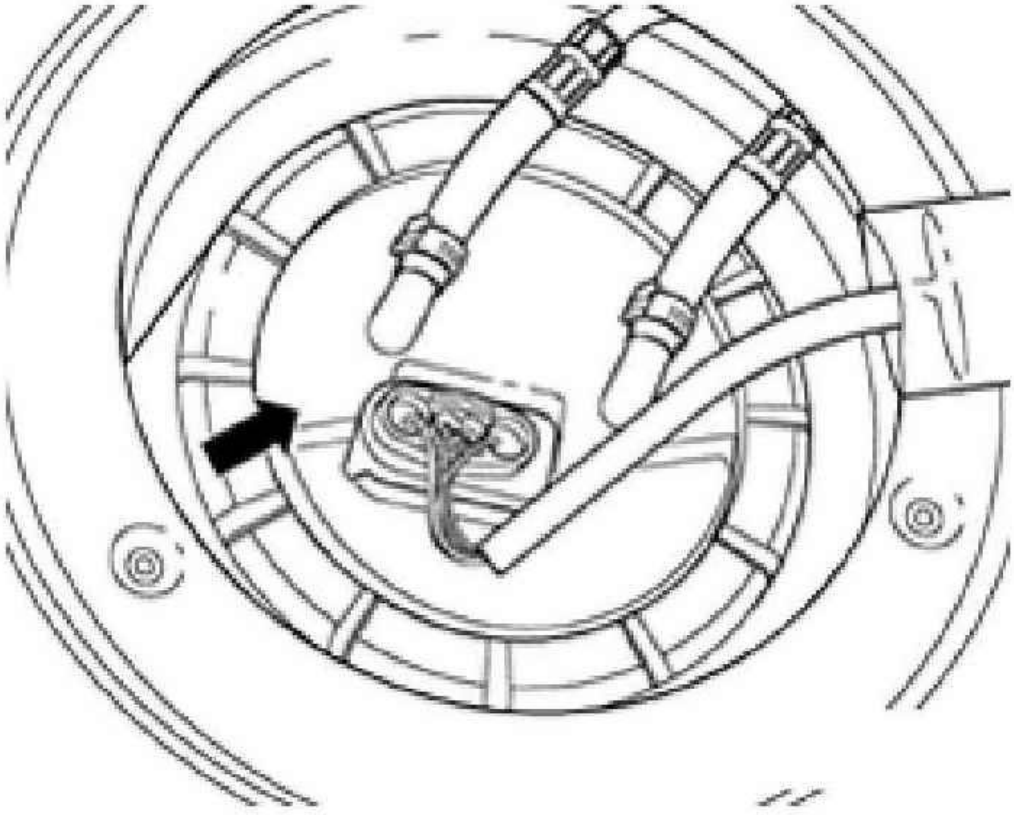

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Fig. 1: Front Exhaust Pipe And Catalyst With Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

MUFFLER WITH MOUNTINGS

NOTE: The following list refers to items in Fig. 2 .

1. From catalytic converter
2. **Double clamp**
   - Note installation position. See **Fig. 3** .
3. **25 N.m**
4. **Mounting**
   - Note installation position. See **Fig. 4** .
5. **Separating point**

- For repair cases.
- Marked by three impressions on circumference of exhaust pipe
- As standard, exhaust pipe and rear mufflers are installed as a single component. In repair cases exhaust pipe and rear muffler are supplied individually with a double clamp for connecting together.
- Cut through connecting pipe with body saw e.g. V.A.G 1523 at right angles at separating point. See **Fig. 5** .

6. **Bracket**
   - With suspension
7. **Muffler**
   - Aligning rear muffler free of stress. See **Fig. 7** .
8. **Mounting**
   - With retaining ring.
9. **20 N.m**
10. **Tunnel bridge**
11. **40 N.m**

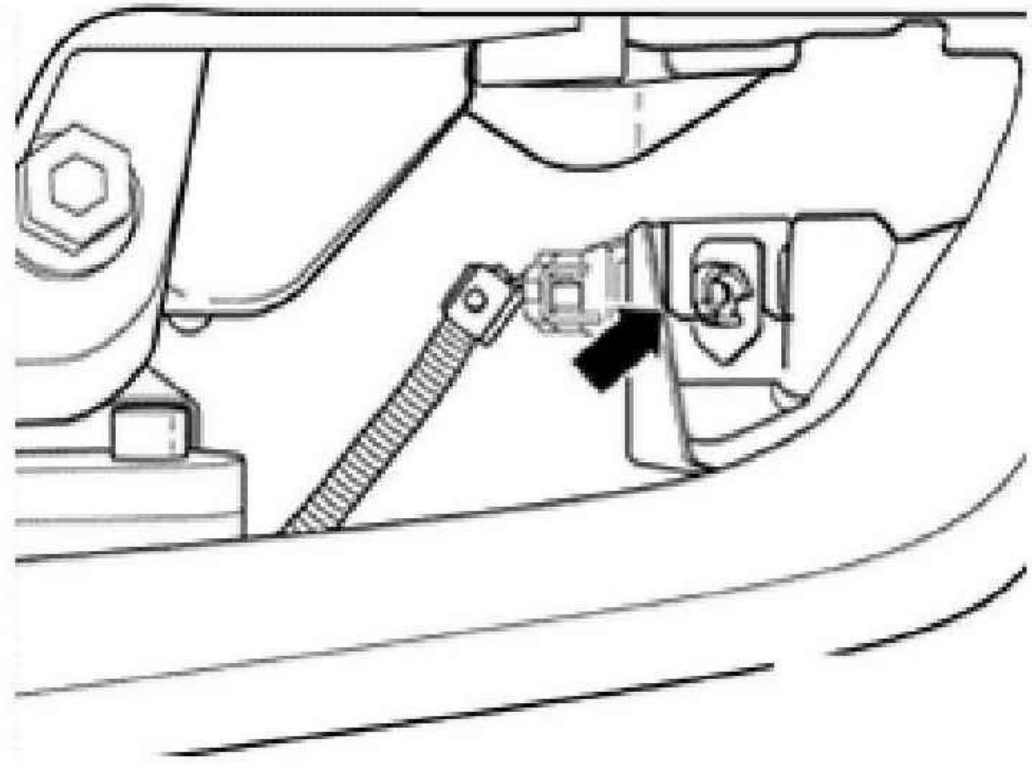

Fig. 2: Identifying Muffler With Mountings
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Double clamp, installation position

Fig. 3: Identifying Double Clamp Installation Position
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Position double clamp approx. 5 mm from mark A (arrow -2-).

NOTE:

- **Mark "A" (arrow -2-) is valid for vehicles with manual and automatic transmissions.**
- **Mark "S" (arrow -1-) is not valid for this engine.**

Mounting, installation position

Fig. 4: Identifying Mounting, Installation Position
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Angled side on base of mounting (arrow) points forward.

Exhaust pipe, separating point

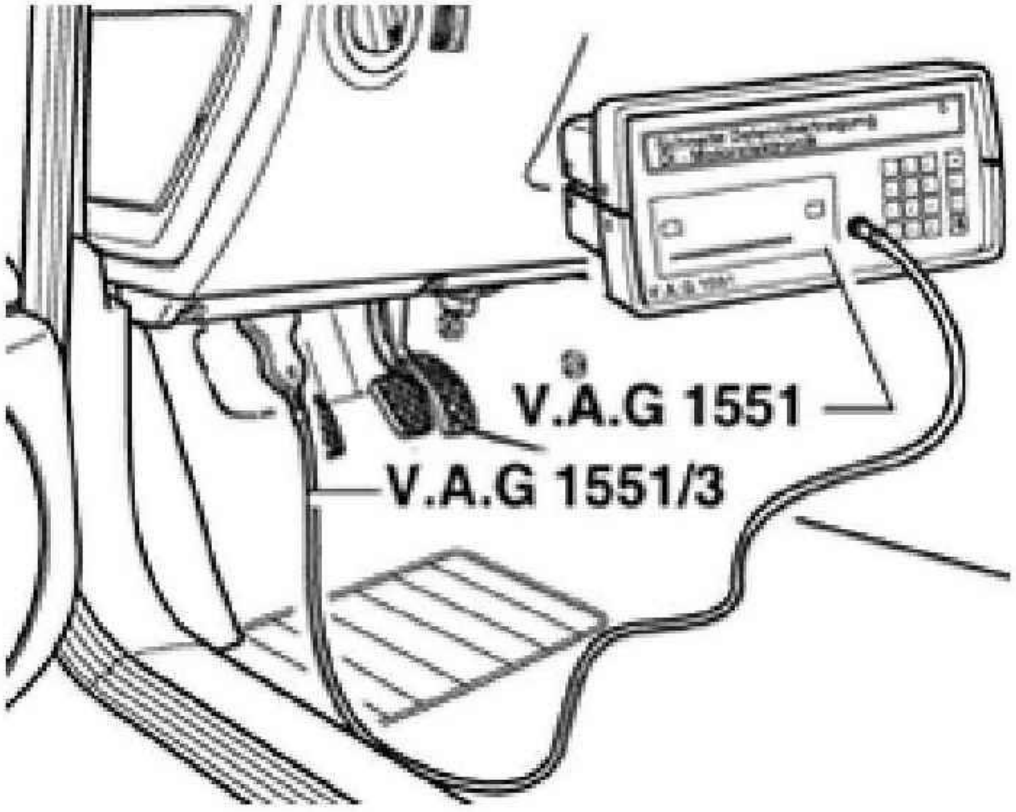

Fig. 5: Identifying Exhaust Pipe, Separating Point
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Special tools and equipment

- Body saw e.g. V.A.G 1523
  - Separate exhaust pipe at right angles at separating point (arrow -2-).
  - When installing, position double clamp -4- on side markings (arrows -1- and -3-).

    Tightening torque: 40 N.m

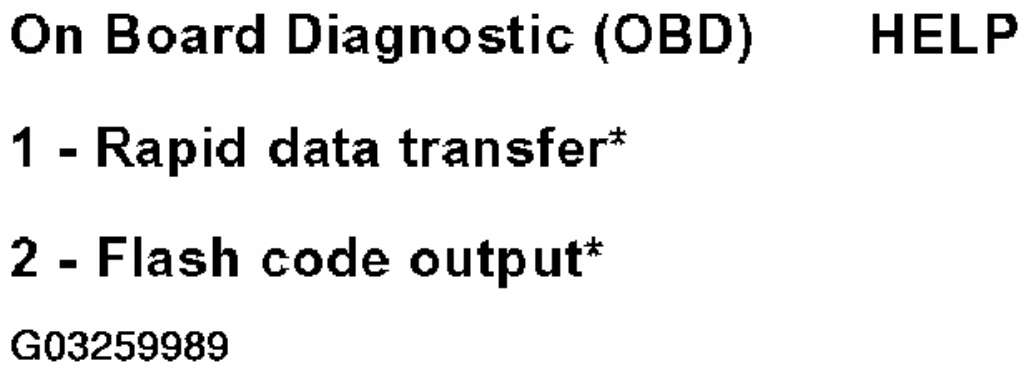

Fig. 6: Positioning Double Clamp On Side Markings While Installing
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Aligning rear muffler free of stress

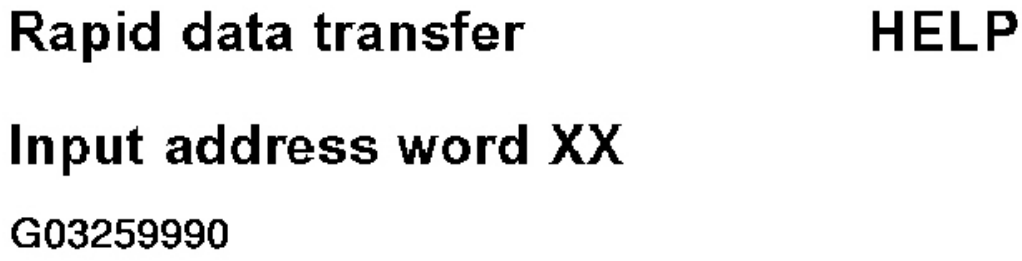

Fig. 7: Aligning Rear Muffler Free Of Stress
Courtesy of VOLKSWAGEN OF AMERICA, INC.

The mounting pins on exhaust pipe must run parallel with tunnel bridge (dimension -x- on left and right the same).

EXHAUST GAS RECIRCULATION SYSTEM

NOTE:

- **The function/control of the exhaust gas recirculation system is undertaken by Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) -J248- via EGR Vacuum Regulator Solenoid Valve -N18-.**

- **Pulsed control makes every conceivable valve position possible.**
- **Replace self-locking nuts.**
- **Vacuum hose connection diagram. See VACUUM HOSE CONNECTION DIAGRAM .**
- **Coolant hose connection diagram. See COOLANT HOSE CONNECTION DIAGRAM .**

EXHAUST GAS RECIRCULATION SYSTEM COMPONENTS, REMOVING AND INSTALLING

NOTE: The following list refers to items in Fig. 8 .

1. **Bracket**
   - For bypass flap for exhaust gas recirculation cooler
2. **22 N.m**
3. **5 N.m**
4. **Intake manifold**
   - With Motor for intake flap -V157-
5. **O-ring**
   - Always replace
6. **EGR Vacuum Regulator Solenoid Valve -N18-**
   - Removing and installing. See **EGR VACUUM REGULATOR SOLENOID VALVE -N18- ,REMOVING AND INSTALLING**
7. **10 N.m**
8. **Seal**
   - Always replace
9. **Connecting pipe**
10. **Radiator**
    - For exhaust gas recirculation
    - Installing. See **EXHAUST GAS RECIRCULATION COOLER, INSTALLING** .
    - Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM** .
11. **Exhaust manifold**
    - Can only be replaced completely with turbocharger
    - Removing and installing. See **TURBOCHARGER SYSTEM COMPONENTS, REMOVING AND INSTALLING** .
12. **Seal**
    - Always replace
13. **Connecting pipe**
14. **Seal**
    - Always replace

15. **Bypass flap**
    - Vacuum hoses for connection diagram. See **VACUUM HOSE CONNECTION DIAGRAM** .
    - Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM** .
    - Installing. See **EXHAUST GAS RECIRCULATION COOLER, INSTALLING** .

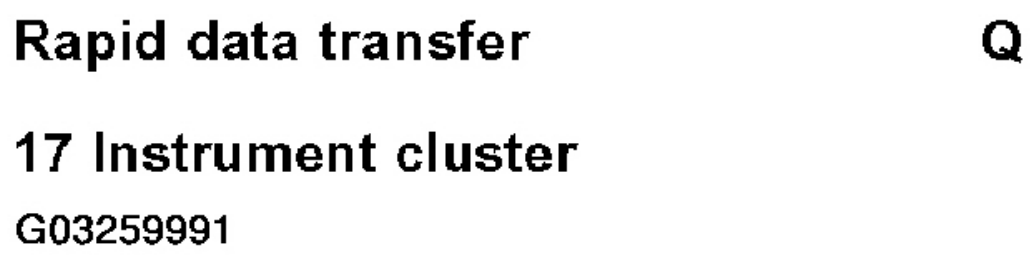

Fig. 8: Exploded View Of Intake Manifold, Exhaust Manifold & Exhaust Gas Recirculation System Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

EXHAUST GAS RECIRCULATION COOLER, INSTALLING

Special tools and equipment

- V.A.G 1331 Torque wrench (5 to 50 N.m)

NOTE: **Description of repair must be observed in order to avoid damages caused by stress.**

Fig. 9: Identifying V.A.G 1331 Torque Wrench

Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Assemble bypass flap -1- with sealing ring -2- and two screws -5- with exhaust gas heat exchanger -3- and tighten these screws.
- Install four screws -4- and tighten all screws to 10 N.m.

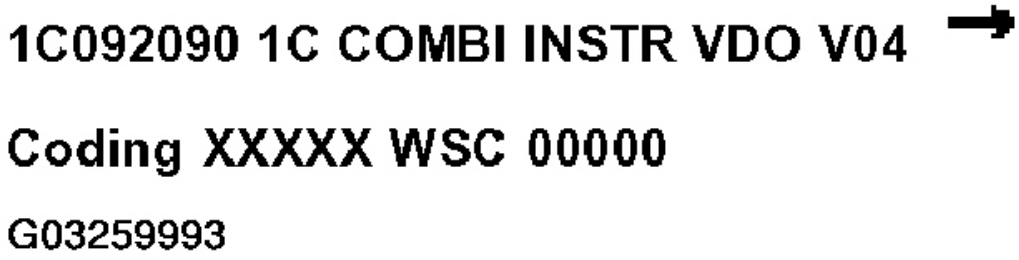

Fig. 10: Assembling Bypass Flap With Sealing Ring And Two Screws
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Hand-tighten exhaust gas recirculation radiator -7- with three screws -8- to intake manifold -6- (exhaust gas recirculation radiator must lie against and must be moveable in threaded joints).
- Install screws -9- and tighten to 10 N.m.
- Tighten bolts/screws -8- to 10 N.m.

Fig. 11: Hand-Tightening Exhaust Gas Recirculation Radiator With Three Screws To Intake Manifold
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Hand-tighten connecting pipe -15- with seals, two screws -14- and screw -16-. See **Fig. 12** .
- Hand-tighten bracket -12- with screws -11 - and -13- to bypass-flap.
- Install bracket -12- with screw -10- to intake manifold and tighten screw to 10 N.m.

- Tighten screw -11 - to 22 N.m.
- Tighten screw -13- to 5 N.m.
- Tighten screws -14- and -16- to 22 N.m.

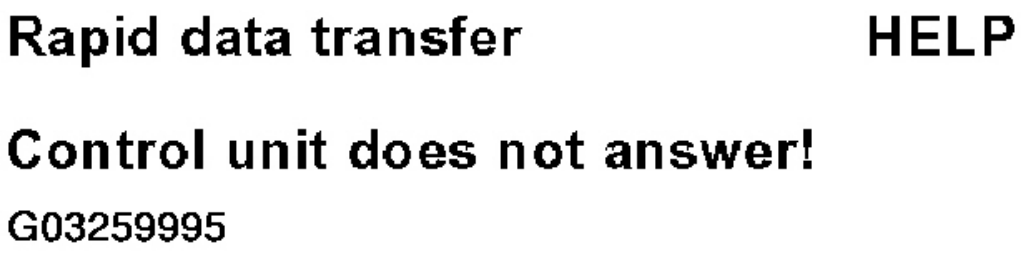

Fig. 12: Hand-Tightening Connecting Pipe With Seals, Two Screws And Screw
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Install connecting pipe -18- from heat exchanger for exhaust gas recirculation -16- to exhaust manifold -17-.
- Tighten bolts and nuts to 22 N.m.

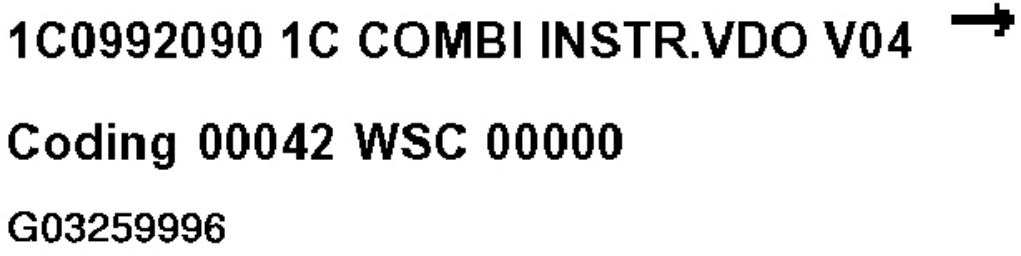

Fig. 13: Installing Connecting Pipe From Heat Exchanger For Exhaust Gas Recirculation To Exhaust Manifold
Courtesy of VOLKSWAGEN OF AMERICA, INC.

EGR VACUUM REGULATOR SOLENOID VALVE -N18-, REMOVING AND INSTALLING

Special tools and equipment

- V.A.G 1331 Torque wrench (5 to 50 N.m)
- VAS 5128 Wet and dry cleaner
- Brush with plastic bristles

Fig. 14: Identifying V.A.G 1331 Torque Wrench
Courtesy of VOLKSWAGEN OF AMERICA, INC.

NOTE: To avoid damage to exhaust gas recirculation valve do not use solvents, fuel or sharp-edged tools or tools made out of metal to clean.

- Disconnect connector from exhaust gas recirculation valve and remove securing bolts.
- Pull valve carefully out of seat.

NOTE: For protection against soot particles, cover intake manifold inner part with a lint-free cloth.

- Clean sooted surfaces with a plastic brush. Afterward, remove loose soot with a cloth.
- Clean exhaust gas recirculation valve seat in intake manifold with a plastic brush and a cloth. Make sure that no soot particles enter intake manifold.
- Take cloth out of intake manifold and clean intake manifold with a vacuum cleaner, if necessary.
- Replace O-ring.
- Insert valve carefully into seat in intake manifold and tighten screws to 10 N.m.

Exhaust System, Emission Controls - 2.0L New Beetle (AEG, AVH, AZG, BDC, BEV & BGD)

EXHAUST SYSTEM COMPONENTS, REMOVING AND INSTALLING

NOTE:

- **After working on the exhaust system ensure that the system is not under stress, and that it has sufficient clearance to the bodywork. If necessary, loosen double clamp(s) and align muffler and exhaust pipe so that sufficient clearance is maintained to the bodywork and the support rings are evenly loaded.**
- **Replace self-locking nuts.**

Special tools, equipment, testers, measuring instruments and auxiliary items required

- 3337 Ring spanner for oxygen sensor
- V.A.G 1331 Torque wrench (5...50 N.m)
- V.A.G 1332 Torque wrench (40...200 N.m)

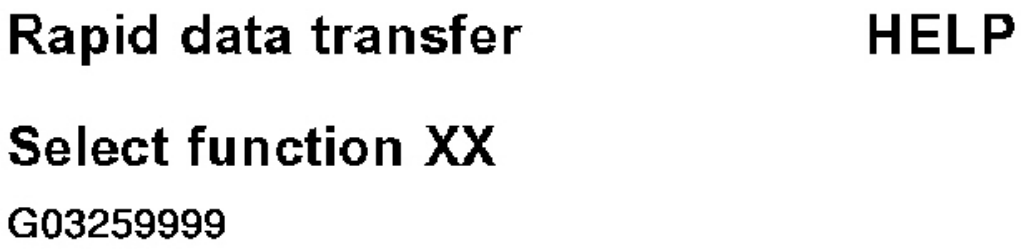

Fig. 1: Identifying Exhaust System Special Tools And Measuring Instruments
Courtesy of VOLKSWAGEN OF AMERICA, INC.

EXHAUST MANIFOLD, FRONT EXHAUST PIPE AND CATALYTIC CONVERTER WITH ATTACHMENTS

Engine code: AEG

- Engine codes AVH, AZG, BDC, BEV, BGD. See **ENGINE CODES AVH, AZG, BDC, BEV, BGD** .

NOTE: **The following list refers to items in Fig. 2 .**

1. **Combination valve**
   - Checking. See **COMBINATION VALVE, CHECKING**
   - Removing and installing. See **COMBINATION VALVE, REMOVING AND INSTALLING**
2. **10 N.m**
3. **25 N.m**
4. **40 N.m**
5. **25 N.m**
   - Replace
6. **Connecting pipe**
   - For secondary air inlet
7. **Nuts/bolts, 60 N.m**
8. **Connector**
   - Black, 6-pin
   - Gold plated contacts
   - For oxygen and oxygen sensor heating
9. **Heated Oxygen Sensor (HO2S) -G39-**
   - 50 N.m
   - Grease only threads with hot bolt paste G 052 112 A3. Paste must not get into slots on sensor body
   - Remove and install with 3337
10. **Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130-**
    - 50 N.m
    - Grease only threads with hot bolt paste G 052 112 A3. Paste must not get into slots on sensor body
    - Remove and install with 3337
11. **4-pin connector**
    - Brown
    - Contacts 3 and 4 are gold plated
    - For oxygen and oxygen sensor heating
12. **To center muffler**
13. **Front exhaust pipe with catalytic converter**
14. **40 N.m**
    - Replace
15. **Support**
16. **Seal**
    - Replace
17. **Exhaust manifold**
    - Removing and installing. See **MUFFLER, REMOVING AND INSTALLING**
18. **Warm air collector plate**

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Select function XX

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Fig. 2: Removing And Installing Exhaust Manifold, Front Exhaust Pipe And Catalytic Converter (Engine Code AEG)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Engine codes AVH, AZG, BDC, BEV, BGD

NOTE: The following list refers to items in Fig. 3 .

1. **Warm air collector plate**
   - With intake manifold support
   - With mounting for combination valve
2. **Heated Oxygen Sensor (HO2S) -G39-**
   - 50 N.m
   - Grease only threads with hot bolt paste G 052 112 A3. Paste must not get into slots on sensor body
   - Remove and install with 3337
3. **Connector**
   - Black, 6-pin
   - Gold plated contacts
   - For oxygen and oxygen sensor heating
4. **Combination valve**
   - Checking. See **COMBINATION VALVE, CHECKING**
   - Removing and installing. See **COMBINATION VALVE, REMOVING AND INSTALLING**
5. **10 N.m**
6. **25 N.m**
7. **25 N.m**
   - Replace
8. **40 N.m**
9. **Connecting pipe**

- For secondary air inlet

10. **Bolts, 60 N.m**
11. **25 N.m**
12. **Retainer**
13. **Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC)-G130-**
    - 50 N.m
    - Grease only threads with hot bolt paste G 052 112 A3. Paste must not get into slots on sensor body
    - Remove and install with 3337
14. **4-pin connector**
    - Brown
    - Contacts 3 and 4 are gold plated
    - For oxygen and oxygen sensor heating
15. **Front exhaust pipe with catalytic converter**
    - With anti-vibration element
16. **10 N.m**
17. **To center muffler**
18. **Heat shield**
    - For catalytic converter
19. **5 N.m**
20. **Speed nut**
    - Install from rear and press forward onto limit stop
21. **25 N.m**
    - Replace
22. **Seal**
    - Replace
23. **Exhaust manifold**
    - Removing and installing. See **MUFFLER, REMOVING AND INSTALLING**
24. **Seal**
    - Replace

Rapid data transfer Q

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Fig. 3: Removing And Installing Exhaust Manifold, Front Exhaust Pipe And Catalytic Converter (Engine Codes AVH, AZG, BDC, BEV And BGD)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

MUFFLER WITH MOUNTINGS

NOTE: The following list refers to items in Fig. 4 .

1. **From catalytic converter**
2. **Double clamp**
   - Observe installing position. See **Installation Position Of Double Clamp**
3. **25 N.m**
4. **Hangers/mountings**
   - Observe installed position. See **Installation Position Of Mounting**
5. **Forward muffler**
   - Aligning. See **Aligning Center Muffler Stress Free**
6. **Separating point**
   - For repair cases
   - As standard, front and rear mufflers are installed as a single component. In repair cases front and rear mufflers are supplied individually with a double clamp for connecting together.
   - Cut through connecting pipe with body saw e.g. V.A.G 1523 at right angles at separating point. See **Separating point on exhaust pipe**
7. **20 N.m**
8. **Hangers/mountings**
9. **Rear muffler**
10. **Hangers/mountings**
    - With retaining ring
11. **Tunnel bridge**

12. **40 N.m**

Fig. 4: Removing And Installing Muffler With Mounting
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Installation Position Of Double Clamp

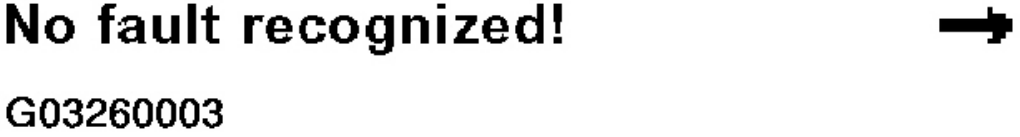

Fig. 5: Identifying Installation Position Of Double Clamp
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Work sequence

- Position double clamp approx. 5 mm away from mark "A" (arrow -2-).

NOTE:

- **Mark "A" (arrow -2-) is valid for models with either a manual or an automatic transmission.**
- **Mark "S" (arrow -1-) is not valid for the engine codes in this manual.**

Installation Position Of Mounting

Angled side on base of mounting (arrow) points forward.

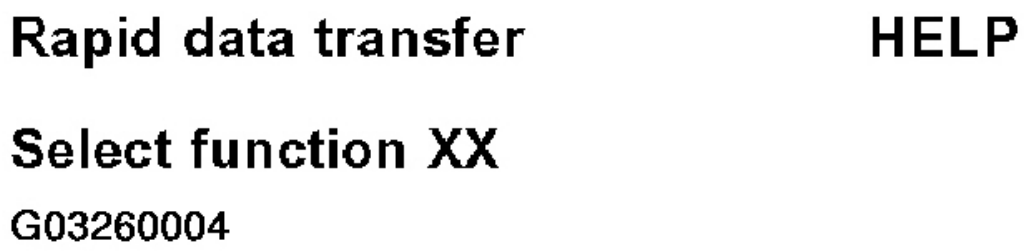

Fig. 6: Identifying Installation Position Of Mounting
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Separating point on exhaust pipe

Special tools, equipment, testers, measuring instruments and auxiliary items required

- Body saw e.g. V.A.G 1523

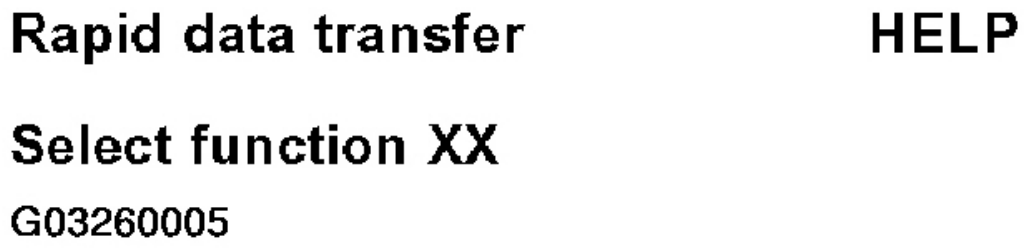

Fig. 7: Identifying Separating Point On Exhaust Pipe
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Work sequence

- Separate exhaust pipe at right angles at separating point (arrow -2-).
- When installing, position repair double clamp -4- at side markings (arrows -1- and -3-). Tighten torque: 40 N.m

Aligning Center Muffler Stress Free

The mounting pins on the exhaust pipe must run parallel with the tunnel bridge (dimension -x- on left and right is the same).

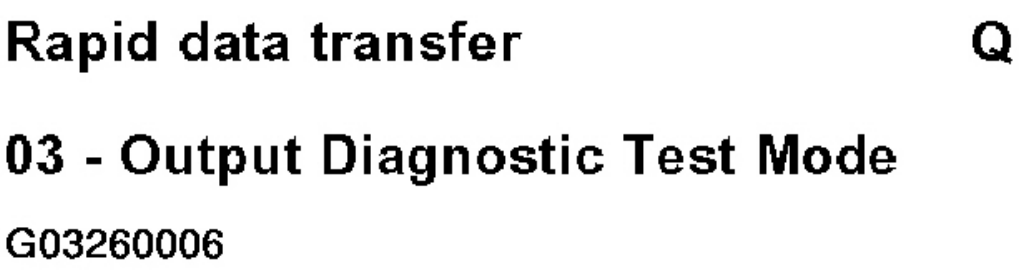

Fig. 8: Aligning Center Muffler Stress Free
Courtesy of VOLKSWAGEN OF AMERICA, INC.

MUFFLER, REMOVING AND INSTALLING

Special tools, equipment, testers, measuring instruments and auxiliary items required

- V.A.G 1331 Torque wrench (5...50 N.m)

Removing

- Remove engine cover.
- Unscrew wiper arms (M8 hex nuts = 20 N.m).

  See **WIPER ARMS** .

- Remove plenum chamber cover (outer) and plenum chamber sealing part.

Fig. 9: Identifying V.A.G 1331 Torque Wrench
Courtesy of VOLKSWAGEN OF AMERICA, INC.

See **PLENUM CHAMBER SEALING ASSEMBLY, REMOVING AND INSTALLING** .

- Remove intake manifold upper part: See **INTAKE MANIFOLD UPPER PART, REMOVING AND INSTALLING** .

NOTE: Seal the intake ports in the intake manifold lower part with clean cloths.

- Pull pressure and vacuum hoses off combination valve.
- Remove connecting pipe between combination valve and exhaust manifold.
- Remove insulation tray.

See **NOISE INSULATION, ASSEMBLY OVERVIEW** .

- Remove right hand inner constant velocity joint protective cover from engine if installed.
- Remove engine/exhaust manifold support.
- Disconnect connector for oxygen sensor -1- and move wiring clear.

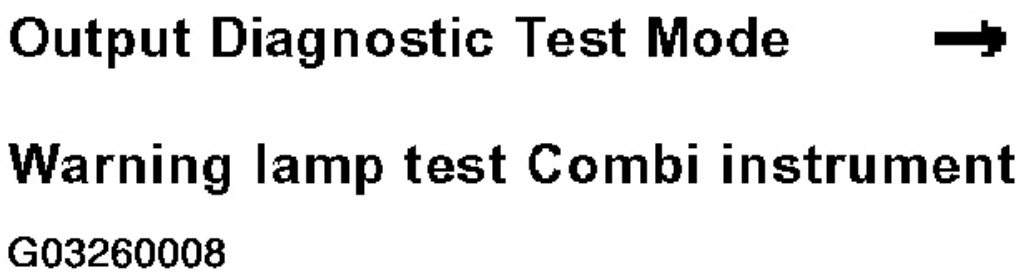

Fig. 10: Disconnecting Connector From Oxygen Sensor
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Remove warm air collector plate.
- Remove securing bolts -2- from exhaust pipe on exhaust manifold.

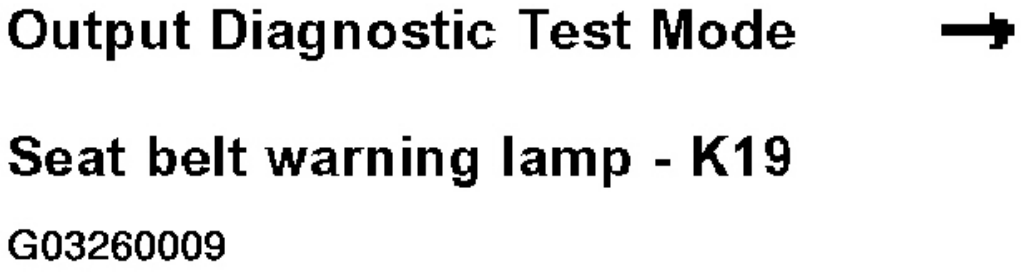

Fig. 11: Removing Securing Bolts From Exhaust Pipe On Exhaust Manifold
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Unbolt four upper nuts -1- as well as four lower from exhaust manifold to cylinder head.
- Remove exhaust manifold upward.

Installing

NOTE:

- **To prevent exhaust gases escaping, the contact surfaces between the exhaust manifold, exhaust pipe and cylinder head must be bolted together correctly.**

- **Replace all seals/gaskets and self-locking nuts.**

Installation is performed in the reverse sequence. Note the following:

- Tightening torques. See **EXHAUST MANIFOLD, FRONT EXHAUST PIPE AND CATALYTIC CONVERTER WITH ATTACHMENTS** and **ENGINE CODES AVH, AZG, BDC, BEV, BGD**
  - Erase fault memory. See **ENGINE CONTROL MODULE FAULT MEMORY, INTERROGATION AND ERASING** .

SECONDARY AIR SYSTEM

WARNING: When performing repair work, especially due to the confined conditions in the engine compartment, pay attention to the following:

- **Route all types of lines (e.g. for fuel, hydraulics, EVAP system, coolant, refrigerant, brake fluid and vacuum) as well as electrical wiring so that the original positions are restored.**
- **Ensure sufficient clearance to all moving or hot components.**

FUNCTION

- The secondary air system blows air in behind the exhaust valve for a maximum of 100 seconds after the cold start (+5° C...+33° C coolant temperature). This produces an oxygen rich exhaust gas which initiates afterburning and reduces the heating-up phase of the catalytic converter.
- Activation occurs from Motronic Engine Control Module (ECM) -J220- via the Secondary Air Injection (AIR) pump relay -J229- to Secondary Air Injection (AIR) solenoid valve -N112-, change-over valve and combination valve. Only vehicles with engine code AEG up to Model Year 1999, 05.99.
- If the secondary air pump motor is activated it produces an overpressure and opens the combination valve at 60 to 70 mbar. Only vehicles with engine codes: AEG as of Model Year 1999, 06.99, AVH, AZG, BDC, BEV and BGD.
- Additionally after each subsequent engine start (up to max. 96 °C engine temperature) the secondary air system will switch in for 10 seconds during idling and will be checked by the self-diagnosis. When doing this the oxygen sensor regulation must be active.

SECONDARY AIR SYSTEM COMPONENTS, REMOVING AND INSTALLING

Engine codes AEG up to Model Year 1999, 05.99

- Engine codes: AEG as of Model Year 1999, 06.99, AVH, AZG, BEV. See **ENGINE CODES: AEG AS OF MODEL YEAR 1999 (06.99) - AVH, AZG AND BEV** .
- Engine codes BDC, BGD. See **ENGINE CODES: BDC, BGD** .

NOTE: The following list refers to items in Fig. 12 .

1. **Connector**
   - 2-pin
2. **Secondary Air Injection (AIR) solenoid valve -N112-**
3. **To union on pipe to brake servo**
4. **Secondary Air Injection (AIR) pump relay -J299-**
   - In protective housing for relays. See **Secondary Air Injection (AIR) pump relay -J299-**
   - In engine compartment (in cable guide next to brake master cylinder)
5. **O-ring**
   - Replace
6. **Pressure hose**
   - Check if seated securely
   - Press together at front to release
7. **Intake hose**
   - From air cleaner upper part
   - For secondary air injection pump
   - Check if seated securely
   - Press together at front to release
8. **Secondary Air Injection (AIR) pump motor -V101-**
   - Activation via AIR pump relay -J299-
   - Checking function. See **SECONDARY AIR INJECTION PUMP MOTOR, CHECKING**
9. **10 N.m**
10. **Retainer**
    - For secondary air pump motor
    - Fastened to intake manifold
11. **Connector**
    - 2-pin
12. **25 N.m**
13. **Intake manifold lower part**
14. **To union on exhaust manifold**
15. **40 N.m**
16. **Connecting pipe**
17. **Nuts/bolts, 60 N.m**
18. **Warm air collector plate**
    - With mounting for combination valve
19. **Seal**
    - Replace
20. **Combination valve**

- Checking. See **COMBINATION VALVE, CHECKING**
- Removing and installing. See **COMBINATION VALVE, REMOVING AND INSTALLING**

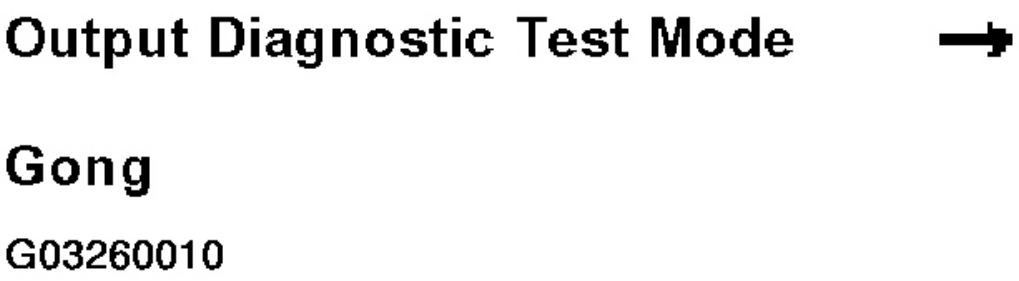

Fig. 12: Exploded View Of Secondary Air System Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Engine codes: AEG as of Model Year 1999 (06.99) - AVH, AZG and BEV

NOTE: The following list refers to items in Fig. 13 .

1. **Combination valve**
   - Checking. See **COMBINATION VALVE, CHECKING**
   - Removing and installing. See **COMBINATION VALVE, REMOVING AND INSTALLING**
2. **Secondary Air Injection (AIR) pump relay -J299-**
   - In protective housing for relays. See **Secondary Air Injection (AIR) pump relay -J299-**
   - In engine compartment (in cable guide next to brake master cylinder)
3. **O-ring**
   - Replace
4. **Pressure hose**
   - Check if seated securely
   - Press together at front to release
5. **Intake hose**
   - From air cleaner upper part
   - For secondary air injection pump
   - Check if seated securely
   - Press together at front to release
6. **Secondary Air Injection (AIR) pump motor -V101-**

- Activation via AIR pump relay -J299-
- Checking function. See **SECONDARY AIR INJECTION PUMP MOTOR, CHECKING**

7. **10 N.m**
8. **Retainer**
    - For secondary air injection pump motor
    - Fastened to intake manifold
9. **Connector**
    - 2-pin
10. **25 N.m**
11. **Intake manifold lower part**
12. **To union on exhaust manifold**
13. **40 N.m**
14. **Connecting pipe**
15. **Nuts/bolts, 60 N.m**
16. **Warm air collector plate**
    - With mounting for combination valve
17. **Seal**
    - Replace

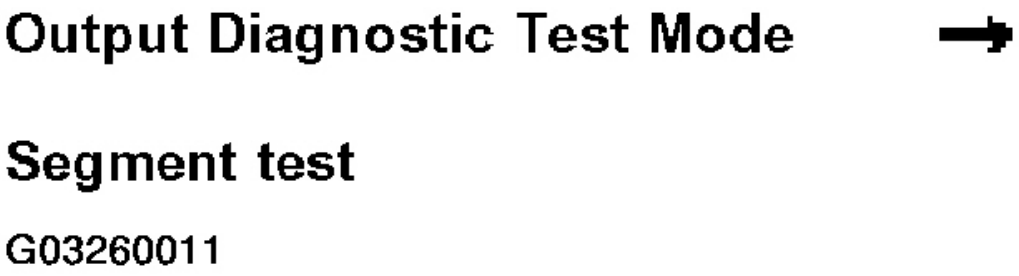

Fig. 13: Exploded View Of Secondary Air Injection (AIR) Pump Motor (Engine Code AEG)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Engine codes: BDC, BGD

NOTE: The following list refers to items in Fig. 14 .

1. **Combination valve**

- Checking. See **COMBINATION VALVE, CHECKING**
- To replace, remove warm air collector plate
- Removing and installing. See **COMBINATION VALVE, REMOVING AND INSTALLING**

2. **O-ring**
   - Replace
3. **Pressure hose**
   - Check if seated securely
   - Press together at front to release
4. **Intake hose**
   - For secondary air injection pump
   - Check if seated securely
   - Press together at front to release
5. **To air cleaner**
6. **Secondary Air Injection (AIR) pump motor -V101-**
   - Activation via AIR pump relay -J299-. See **Secondary Air Injection (AIR) pump relay -J299-**
   - Checking function. See **SECONDARY AIR INJECTION PUMP MOTOR, CHECKING**
7. **Connector**
   - 2-pin
8. **10 N.m**
9. **25 N.m**
10. **15 N.m**
11. **Retainer**
    - For secondary air injection pump motor
    - Secured to intake manifold
12. **Intake manifold lower part**
13. **10 N.m**
14. **To union on exhaust manifold**
15. **40 N.m**
16. **Connecting pipe**
17. **Nuts/bolts, 60 N.m**
18. **Warm air collector plate**
    - With intake manifold support
    - With mounting for combination valve
19. **Seal**
    - Replace

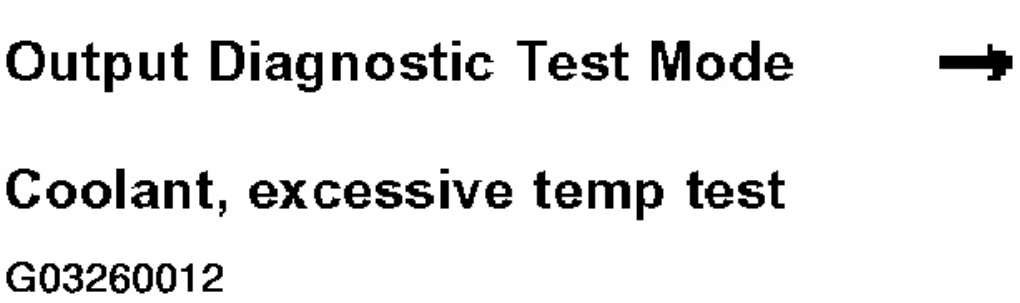

Fig. 14: Exploded View Of Secondary Air Injection (AIR) Pump Motor (Engine Codes BDC And BGD)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Secondary Air Injection (AIR) pump relay -J299-

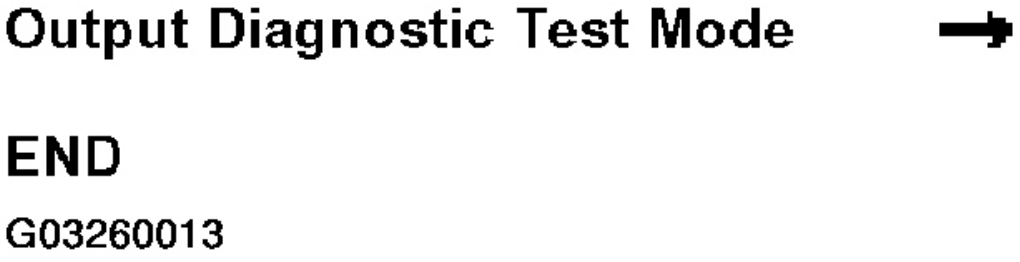

Fig. 15: Identifying Secondary Air Injection (AIR) Pump Relay
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Location: in protective housing for relays in engine compartment (pushed into cable guide next to brake master cylinder).

Distinguishing features: Control number 100

NOTE:

- **The relay locations may differ depending on the level of vehicle equipment. For the latest control numbers and installation locations:**

  See appropriate WIRING DIAGRAMS articles.

- **Disconnect the battery Ground strap first if tools are required to pull relays or control modules out of the relay plate.**
- **Before disconnecting the battery Ground strap obtain the code for radios with anti-theft coding.**

COMBINATION VALVE, CHECKING

Checking combination valve with vacuum connection, up to Model Year 1999, 05.99

Checking combination valve without vacuum connection, from Model Year 2000, 06.99. See **CHECKING COMBINATION VALVE WITHOUT VACUUM CONNECTION, FROM MODEL YEAR 2000, 06.99**

Special tools, equipment, testers, measuring instruments and auxiliary items required

- V.A.G 1390 Hand vacuum pump

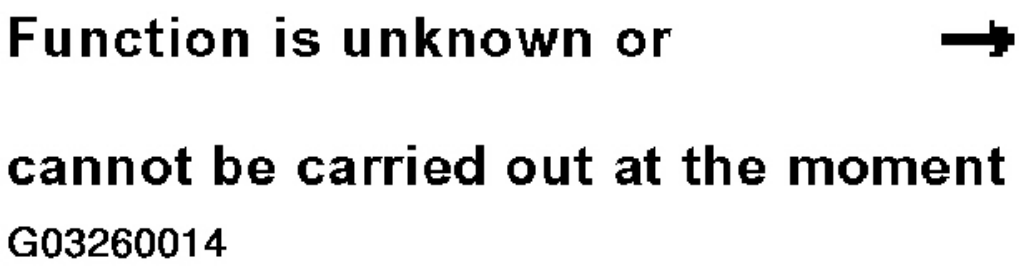

Fig. 16: Identifying V.A.G 1390 Hand Vacuum Pump
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Requirements

- No fault stored in fault memory. See **ENGINE CONTROL MODULE FAULT MEMORY, INTERROGATION AND ERASING** .
- Perform final control diagnosis. See **COMPONENTS AND FUNCTIONS, ADAPTING** .
- Vacuum lines and hose connections free of leaks.
- Vacuum lines not blocked/kinked.

Work sequence

- Remove engine cover.
- Pull vacuum hose -1- off at Secondary Air Injection (AIR) solenoid valve -N112- -2-.

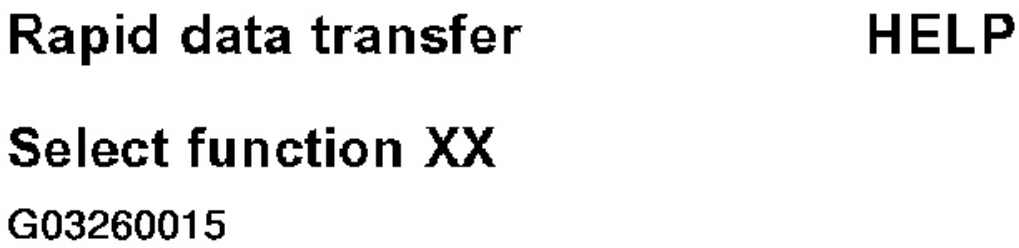

Fig. 17: Pulling Vacuum Hose From Secondary Air Injection (AIR) Solenoid Valve
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Connect hand vacuum pump V.A.G 1390 to vacuum hose -1-.

NOTE: Do not use compressed air during the following check!

- Remove pressure hose at secondary air pump motor and blow in lightly (arrow).
  - Combination valve must be closed
- Operate hand vacuum pump.
  - Combination valve must open

If the combination valve does not open:

- Replace combination valve.

Checking combination valve without vacuum connection, from Model Year 2000, 06.99

Requirements

- No fault stored in fault memory. See **ENGINE CONTROL MODULE FAULT MEMORY, INTERROGATION AND ERASING** .
- Perform final control diagnosis. See **COMPONENTS AND FUNCTIONS, ADAPTING** .
- Hose unions must not leak

Work sequence

NOTE: Do not use compressed air during the following check!

- Remove engine cover.
- Remove pressure hose (arrow) from secondary air injection pump motor.

NOTE: To release, press buttons together on hose coupling.

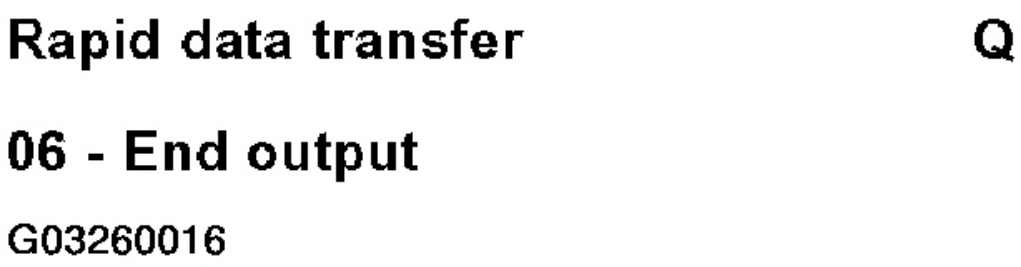

Fig. 18: Removing Pressure Hose From Secondary Air Injection Pump Motor
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Blow lightly into pressure hose to combination valve.
  - Combination valve must be closed.
- Blow strongly into pressure hose to combination valve.
  - Combination valve must open.

When the combination valve does not open or is continuously open:

- Replace combination valve.

COMBINATION VALVE, REMOVING AND INSTALLING

Special tools, equipment, testers, measuring instruments and auxiliary items required

- V.A.G 1331 Torque wrench (5...50 N.m)

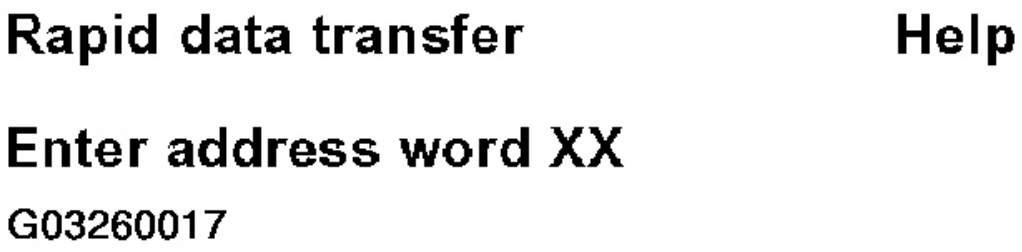

Fig. 19: Identifying V.A.G 1331 Torque Wrench
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- VAS 5085 Step ladder

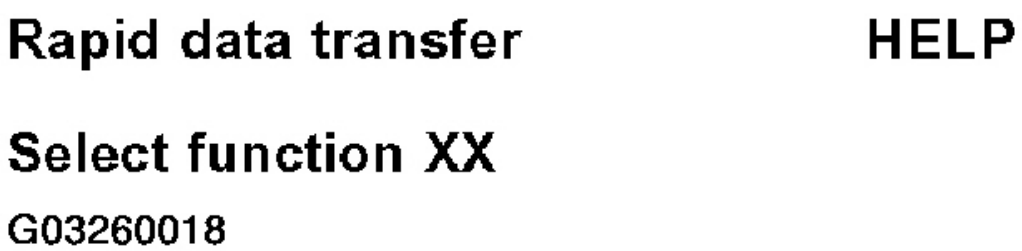

Fig. 20: Identifying VAS 5085 Step Ladder
Courtesy of VOLKSWAGEN OF AMERICA, INC.

NOTE: Always replace seals, gaskets and O-rings.

Removing

From above:

- Remove engine cover.
- Remove intake manifold upper part. See **INTAKE MANIFOLD UPPER PART, REMOVING AND INSTALLING** .
- Pull pressure and vacuum hoses off combination valve.
- Loosen screwed on connections on connection pipe and remove pipe.

From below:

- Remove middle insulation tray.

  See **NOISE INSULATION, ASSEMBLY OVERVIEW** .

- Disconnect connector for Heated Oxygen Sensor (HO2S) -G39-.
- Remove right side inner constant velocity joint protective cover from engine if installed.
- Unbolt connecting pipe on exhaust manifold.
- Remove warm air collector plate with combination valve.

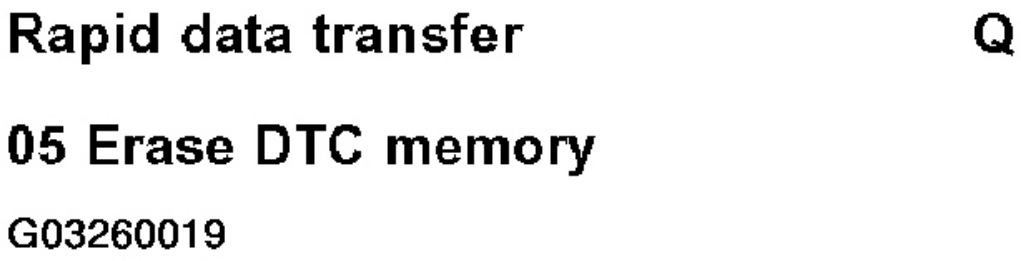

Fig. 21: Removing Warm Air Collector Plate With Combination Valve
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Guide a 5 mm hex bit from 3/8"drive socket set into holes -3- of warm air collector plate -1- and remove bolts -4- for combination valve -2-.
- Remove combination valve.

Installing

NOTE:

- **Thoroughly clean contact surfaces between combination valve and warm air collector plate.**
- **Replace seal.**

The rest of the assembly is basically in reverse order to the disassembly sequence.

SECONDARY AIR INJECTION PUMP MOTOR, CHECKING

Requirements

- No fault stored in fault memory. See **ENGINE CONTROL MODULE FAULT MEMORY,**

INTERROGATION AND ERASING .

- Fuse for Secondary Air Injection (AIR) pump relay -J299- located in the main fuse box on the battery is OK.

Fig. 22: Identifying Fuses Of Secondary Air Injection (AIR) Pump Relay Located In Main Fuse Box
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Secondary air injection pump vacuum lines and hose connections free of leaks.
- Secondary air injection pump vacuum lines not blocked/kinked.

Work sequence

- Remove engine cover.
- Remove pressure hose (arrow) from secondary air injection pump motor.

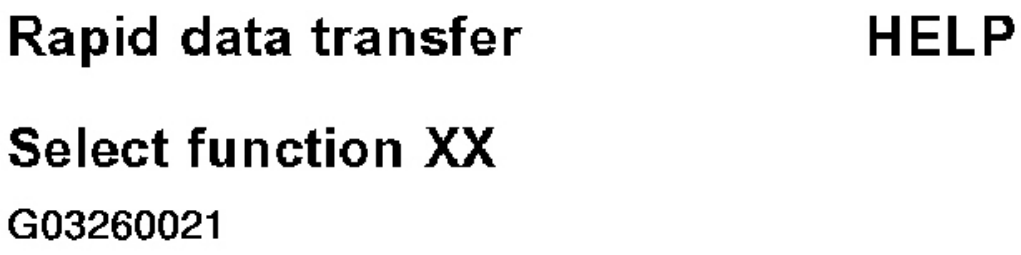

Fig. 23: Removing Pressure Hose From Secondary Air Injection Pump Motor
Courtesy of VOLKSWAGEN OF AMERICA, INC.

NOTE: To release, press buttons together on hose coupling.

- Activate secondary air injection pump relay via final control diagnosis. See **COMPONENTS AND FUNCTIONS, ADAPTING** .
  - Secondary air injection pump motor must run and air must exit outlet connection

If the motor runs, but no air exits:

- Replace secondary air injection pump motor.

If the secondary air injection pump motor does not run at intervals:

- Activate secondary air injection pump relay via final control diagnosis. See **COMPONENTS AND FUNCTIONS, ADAPTING** .
- Check activation of secondary air injection pump motor. See **COMPONENTS AND FUNCTIONS, ADAPTING** .

SECONDARY AIR INJECTION SOLENOID VALVE, CHECKING

Only engine code AEG up to Model Year 1999, 05.99

Special tools, equipment, testers, measuring instruments and auxiliary items required

- Adapter set V.A.G 1594

Fig. 24: Identifying Adapter Set V.A.G 1594
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- V.A.G 1527 B Diode test lamp
- Wiring diagram

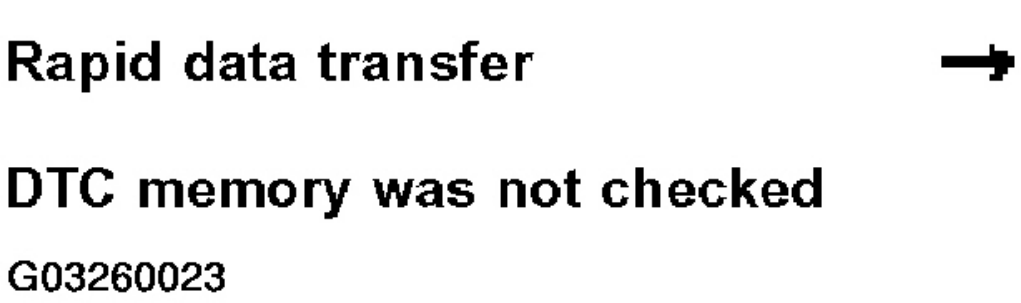

Fig. 25: Identifying V.A.G 1527 B Diode Test Lamp
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Requirements

- Coolant temperature 5...33° C
- Secondary air injection pump motor OK

Work sequence

- Pull upper vacuum hose (arrow) off secondary air injection solenoid valve -1-.

Fig. 26: Disconnecting Upper Vacuum Hose From Secondary Air Injection Solenoid Valve
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Start engine and run at idling speed.
  - When secondary air injection pump motor runs, a vacuum must be detectable at secondary air injection pump union.

If a vacuum cannot be detected:

- Switch off ignition.
- Disconnect 2-pin connector from secondary air injection solenoid valve.
- Connect diode test lamp V.A.G 1527 B to disconnected connector using adapter cables from V.A.G 1594 C.

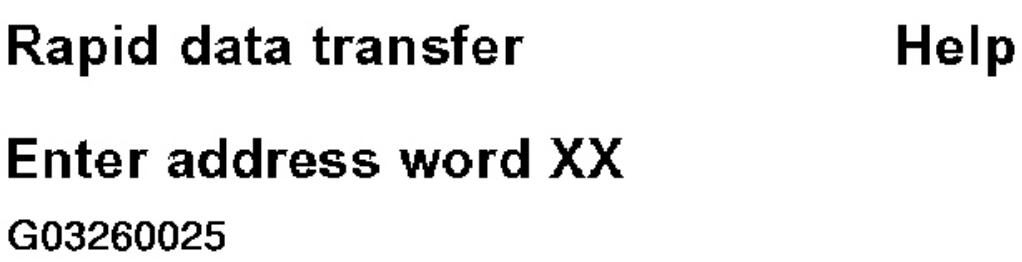

Fig. 27: Connecting Diode Test Lamp V.A.G 1527 B To Disconnected Secondary Air Injection Solenoid Valve Connector
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Start engine and run at idling speed.
  - LED must light up

LED lights up (voltage supply OK):

- Replace secondary air injection solenoid valve.

LED does not light up:

- Connect 2-pin connector.
- Check activation of valve. See **COMPONENTS AND FUNCTIONS, ADAPTING** .
- Check wiring connections plate according to wiring diagram.

  See appropriate WIRING DIAGRAMS article.

- Interrogate fault memory. See **ENGINE CONTROL MODULE FAULT MEMORY, INTERROGATION AND ERASING** .
- Read readiness code. See **COMPONENTS AND FUNCTIONS, ADAPTING** .
- If fault memory has been erased or engine control module separated from permanent positive power supply, generate readiness code again. See **COMPONENTS AND FUNCTIONS, ADAPTING** .

EXHAUST SYSTEM EMISSION CONTROLS

EXHAUST SYSTEM COMPONENTS, REMOVING AND INSTALLING

NOTE:

- **After exhaust system repairs, make sure exhaust system is not under stress and that it has sufficient clearance from the bodywork. If necessary, loosen double clamps and align muffler and exhaust pipe so that sufficient clearance is maintained to the bodywork and mounts carry uniform loads.**
- **Do not use any silicone sealant. Traces of silicone components which are sucked into the engine are not burned there, and they damage the oxygen sensor.**
- **Always replace self-locking nuts.**
- **Components marked with * are tested via On Board Diagnostic (OBD). See DIAGNOSTIC MODE 3: CHECK DTC MEMORY .**

Exhaust manifold, front exhaust pipe with Three Way Catalytic Converter (TWC) and attachments:

- Vehicles with engine code AEG. See **EXHAUST MANIFOLD, FRONT EXHAUST PIPE WITH THREE WAY CATALYTIC CONVERTER (TWC) AND ATTACHMENTS (VEHICLES WITH ENGINE CODE AVH, AZG, BDC)** .
- Vehicles with engine code AVH, AZG, BDC **EXHAUST MANIFOLD, FRONT EXHAUST PIPE WITH THREE WAY CATALYTIC CONVERTER (TWC) AND ATTACHMENTS (VEHICLES WITH ENGINE CODE AVH, AZG, BDC)** .

Mufflers with mounts. See **MUFFLERS WITH MOUNTS** .

Check catalytic converter. See **CATALYTIC CONVERTER, CHECKING** .

Exhaust manifold, front exhaust pipe with Three Way Catalytic Converter (TWC) and attachments (vehicles with engine code AEG)

NOTE: The following list refers to Fig. 1 .

1. **Combination valve**
   - Checking. See **COMBINATION VALVE, CHECKING** .

     Vehicles with engine code AEG as of 06.99:

   - without vacuum connection to Secondary Air Injection (AIR) solenoid valve -N112-
2. **10 Nm**

3. **25 Nm**
4. **30 Nm**
5. **25 Nm**
    - replace
6. **Connection tube**
7. **Connecting piece, 35 Nm**
8. **4-pin harness connector**
    - Black
    - For Heated Oxygen Sensor (HO2S) 1 before Three Way Catalytic Converter (TWC) -G39- and Oxygen Sensor (O2S) heater -Z19-
    - Component location: At right vehicle underside
    - Component location: At right vehicle underside
9. **Heated Oxygen Sensor (HO2S) -G39- bank 1*, 50 Nm**
    - Component location: in front catalytic converter
    - Only use "G 052 112 A3" to grease thread; do not let "G 052 112 A3" get onto slit of oxygen sensor
    - Voltage supply of oxygen sensor heater via Fuel Pump (FP) Relay -J17-
    - Check oxygen sensor heater for Oxygen Sensor (O2S) before Three Way Catalytic Converter (TWC). See **OXYGEN SENSOR HEATER FOR OXYGEN SENSOR BEFORE THREE WAY CATALYTIC CONVERTER (TWC), CHECKING** .
    - Check Oxygen Sensor (O2S) and oxygen sensor control before Three Way Catalytic Converter (TWC). See **CHECK OXYGEN SENSOR AND OXYGEN SENSOR REGULATION BEFORE CATALYTIC CONVERTER** .
10. **Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- bank 1*, 50 Nm**
    - Component location: In rear catalytic converter
    - Only use "G 052 112 A3" to grease thread; do not let "G 052 112 A3" get onto slit of oxygen sensor
    - Voltage supply of oxygen sensor heater via Fuel Pump (FP) Relay -J17-
    - Check oxygen sensor heater for Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC). See **OXYGEN SENSOR HEATER FOR OXYGEN SENSOR BEHIND THREE WAY CATALYTIC CONVERTER (TWC), CHECKING** .
    - Check Oxygen Sensor (O2S) and oxygen sensor control behind Three Way Catalytic Converter (TWC). See **CHECK OXYGEN SENSOR AND OXYGEN SENSOR REGULATION BEHIND CATALYTIC CONVERTER** .
11. **4-pin harness connector**
    - brown
    - For Heated Oxygen Sensor (HO2S) 2 behind Three Way Catalytic Converter (TWC) -G130- and heater for lambda-probe 1 -Z29-
    - Component location: At right vehicle underside
12. **to front muffler**

- See item 1 .

13. **Front exhaust pipe with catalytic converter**
    - Check catalytic converter. See **CATALYTIC CONVERTER, CHECKING** .
14. **40 Nm**
    - replace
15. **Bracket**
16. **Seal**
    - replace
17. **Exhaust manifold**
18. **Heat shield**

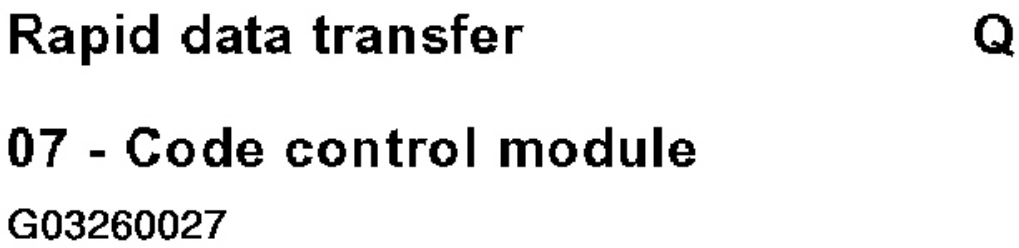

Fig. 1: Identifying Exhaust Manifold, Front Exhaust Pipe With Three Way Catalytic Converter And Attachments (Vehicles With Engine Code AEG)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Exhaust manifold, front exhaust pipe with Three Way Catalytic Converter (TWC) and attachments (vehicles with engine code AVH, AZG, BDC)

NOTE: The following list refers to Fig. 2 .

1. **Heat shield**
2. **Heated Oxygen Sensor (HO2S) -G39- bank 1*, 50 Nm**
    - Component location: In exhaust manifold
    - Use "G5" to grease thread only; do not let "G5" get onto slits of oxygen sensor body
    - Voltage supply of oxygen sensor heater via Fuel Pump (FP) Relay - J17-
    - Check oxygen sensor heater for Oxygen Sensor (O2S) before Three Way Catalytic Converter (TWC). See **OXYGEN SENSOR HEATER FOR OXYGEN SENSOR BEFORE THREE WAY CATALYTIC CONVERTER (TWC), CHECKING** .
    - Check Oxygen Sensor (O2S) and oxygen sensor control before Three Way Catalytic Converter

(TWC). See **CHECK OXYGEN SENSOR AND OXYGEN SENSOR REGULATION BEFORE CATALYTIC CONVERTER** .

3. **10 Nm**
4. **25 Nm**
5. **25 Nm**
   - replace
6. **Connection tube**
7. **Connecting piece, 35 Nm**
8. **Exhaust manifold**
9. **Seal**
   - replace
10. **Front exhaust pipe with catalytic converter**
    - Check catalytic converter. See **CATALYTIC CONVERTER, CHECKING** .
11. **Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) - G130- bank 1*, 50 Nm**
    - Component location: In rear catalytic converter
    - Only use "G 052 112 A3" to grease thread; do not let "G 052 112 A3" get onto slit of oxygen sensor
    - Voltage supply of oxygen sensor heater via Fuel Pump (FP) Relay - J17-
    - Check oxygen sensor heater for Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC). See **OXYGEN SENSOR HEATER FOR OXYGEN SENSOR BEHIND THREE WAY CATALYTIC CONVERTER (TWC), CHECKING** .
    - Check Oxygen Sensor (O2S) and oxygen sensor control behind Three Way Catalytic Converter (TWC). See **CHECK OXYGEN SENSOR AND OXYGEN SENSOR REGULATION BEHIND CATALYTIC CONVERTER** .
12. **10 Nm**
13. **Heat shield**
    - for catalytic converter
14. **10 Nm**
15. **Spring nut**
16. **Suspended mount**
17. **25 Nm**
18. **40 Nm**
    - replace
19. **Seal**
    - replace

Code Control Module

Enter code number XXXXX (0-32000)

G03260028

Fig. 2: Identifying Exhaust Manifold, Front Exhaust Pipe With Three Way Catalytic Converter And Attachments (Vehicles With Engine Code AVH, AZG, BDC)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Mufflers with mounts

NOTE: The following list refers to Fig. 3 .

1. **From Three Way Catalytic Converter (TWC)**
2. **Double clamp**
   - replace
   - Note installed position. See **Installation position of double clamp** .
3. **25 Nm**
4. **Suspended mount**
   - Note installed position. See **Installation position of muffler suspension** .
5. **Front muffler**
   - At factory, front and rear mufflers are installed as a single component. Replacement front and rear mufflers are supplied separately, with replacement double clamp for connecting joint.
   - Install front muffler parallel. See **Aligning front muffler parallel** .
6. **Separating point**
   - Separation point at exhaust pipe. See **Separation point at exhaust pipe** .
7. **Suspended mount**
8. **Bracket**
9. **Rear muffler**
   - At factory, front and rear mufflers are installed as a single component. Replacement front and rear mufflers are supplied separately, with replacement double clamp for connecting joint.
10. **Suspended mount**
    - With retainer ring

11. **20 Nm**
12. **Tunnel bridge**
13. **40 Nm**
14. **Washer**

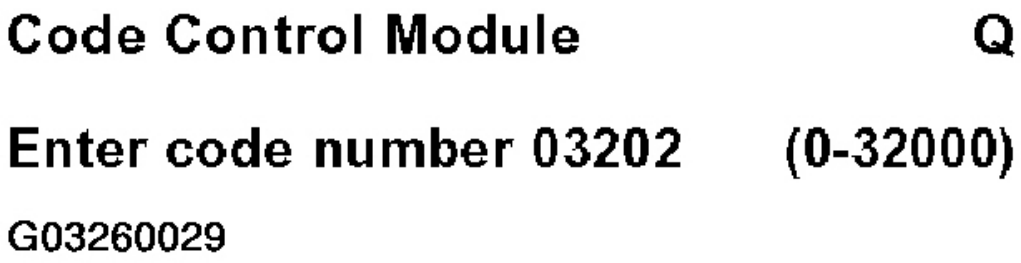

Fig. 3: Identifying Mufflers With Mounts Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Installation position of double clamp

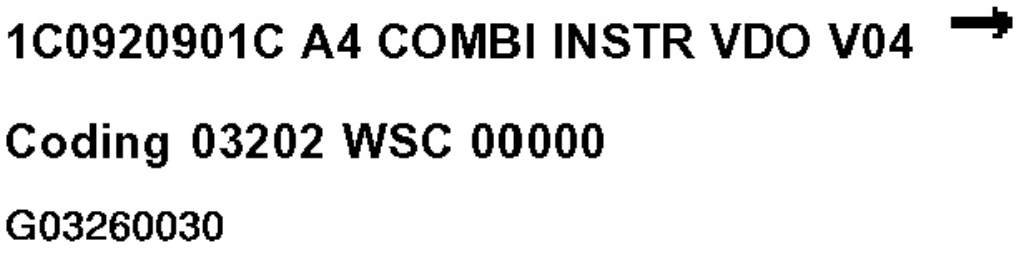

Fig. 4: Identifying Installation Position Of Double Clamp
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Work procedure

- Position new double clamp as shown with approx. 5 mm distance to marking -A- and tighten it. Tightening torque 40 Nm
  - Marking A (arrow 1) for vehicles with automatic transmission

- Marking S (arrow 2) for vehicles with manual transmission

Installation position of muffler suspension

- Angled side at foot of suspension (arrow) faces front of vehicle.

Fig. 5: Identifying Installation Position Of Muffler Suspension
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Separation point at exhaust pipe

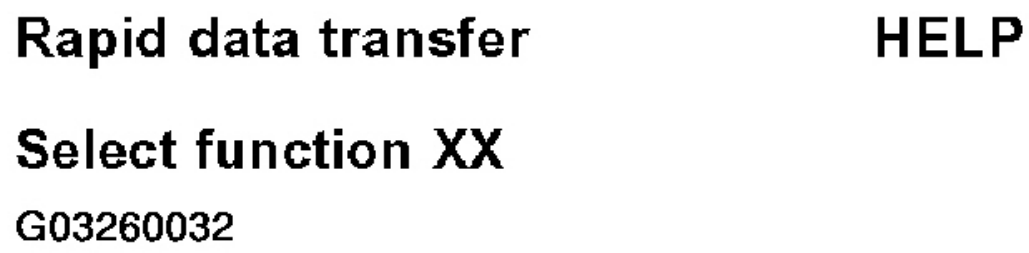

Fig. 6: Identifying Separation Point At Exhaust Pipe
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Recommended special tools and equipment

- Body saw, e.g. VAG1523

Work procedure

- Separate exhaust pipe at right angle to separation point (arrow 2).
- Position replacement double clamp -4- in installation position at the edge markings (arrows 1 and 3) as shown when installing. Tightening torque 40 Nm

Aligning front muffler parallel

- Mounting bolt at exhaust pipe must be parallel to tunnel bridge (dimension -x- same at left and right).

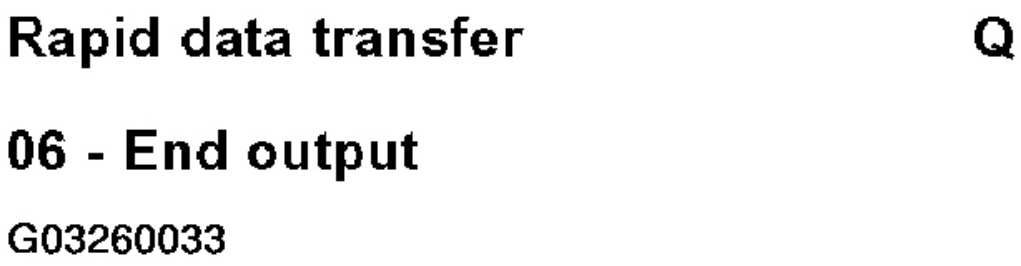

Fig. 7: Aligning Front Muffler Parallel
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Catalytic converter, checking

Function test

- Select the measuring value "Test-ID 01: Catalytic converter" and check whether the specified values are being reached. See **DIAGNOSTIC MODE 6: CHECK TEST RESULTS OF COMPONENTS THAT ARE NOT CONTINUOUSLY MONITORED** .
- End diagnosis and switch ignition off.

If the specified values are exceeded:

- Replace the front exhaust pipe with catalytic converter:

- Vehicles with engine code AEG. See item 13 .
- Vehicles with engine code AVH, AZG, BDC. See item 10 .

Continuation for all vehicles

- Erase DTC memory of Engine Control Module (ECM). See **DIAGNOSTIC MODE 4: RESET/ERASE DIAGNOSTIC DATA** .
- Generate readiness code. See **READINESS CODE, GENERATING** .

SECONDARY AIR INJECTION (AIR) SYSTEM

WARNING: Observe the following for all installations, especially in engine

compartment due to lack of room:

- **Route lines of all types (e.g. for fuel, hydraulic, EVAP canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.**
- **Watch for sufficient clearance to all moving or hot components.**

Function

Air is blown behind the exhaust valves by the Secondary Air Injection (AIR) system during a cold start. Thereby, the emission gas is enriched with oxygen, initiating a secondary combustion and thereby shortening the warm-up phase of the catalytic converter. Activation occurs from Motronic Engine Control Module (ECM) -J220- via Secondary Air Injection (AIR) Pump Relay -J299- to combination valve.

Secondary Air Injection (AIR) system components, removing and installing:

- Vehicles with engine code AEG, AVH, AZG. See **PARTS OF SECONDARY AIR INJECTION (AIR) SYSTEM, REMOVING AND INSTALLING (VEHICLES WITH ENGINE CODE AEG, AVH, AZG)** .
- Vehicles with engine code BDC. See **PARTS OF SECONDARY AIR INJECTION (AIR) SYSTEM, REMOVING AND INSTALLING (VEHICLES WITH ENGINE CODE BDC)** .

Check secondary air system for proper seal. See **SECONDARY AIR INJECTION (AIR) SYSTEM, CHECKING FOR PROPER SEAL** .

Parts of Secondary Air Injection (AIR) system, removing and installing (Vehicles with engine code AEG, AVH, AZG)

NOTE: Components marked with * are tested via On Board Diagnostic (OBD). See DIAGNOSTIC MODE 3: CHECK DTC MEMORY .

NOTE: The following list refers to Fig. 8 .

1. **Connector**
   - only for vehicles with engine code AEG up to 05.99
   - black, 2-pin
   - for Secondary Air Injection (AIR) solenoid valve
   - before disconnecting, mark allocation to component
2. **Secondary Air Injection (AIR) Solenoid Valve -N112-***
   - only for vehicles with engine code AEG up to 05.99
   - Checking. See **SECONDARY AIR INJECTION (AIR) SOLENOID VALVE (VEHICLES WITH ENGINE CODE AEG UP TO 05.99), CHECKING** .
3. **to fork of vacuum line for brake booster**
   - only for vehicles with engine code AEG up to 05.99

- Check for secure fitting

4. **Secondary Air Injection (AIR) Pump Relay -J299-***
5. **O-ring**
   - Replace if damaged
6. **Pressure hose**
   - Check for secure fitting
   - To disengage, squeeze together at front
7. **Intake hose**
   - Check for secure fitting
   - To disengage, squeeze together at front
   - from upper air filter housing. See item 6 in **AIR FILTER, DISASSEMBLING AND ASSEMBLING (VEHICLES WITH ENGINE CODE AEG, AVH, AZG)** .
8. **Secondary Air Injection (AIR) Pump Motor -V101-***
   - Checking. See **SECONDARY AIR INJECTION (AIR) PUMP MOTOR, CHECKING** .
9. **10 Nm**
10. **Bracket**
    - For Secondary Air Injection (AIR) pump motor
    - secured to lower part of intake manifold at bottom
11. **Connector**
    - 2-pin
    - For Secondary Air Injection (AIR) pump motor
12. **25 Nm**
13. **Lower part of intake manifold**
14. **to connecting piece at exhaust manifold**

    Vehicles with engine code AEG:

    - See item 7 .

      Vehicles with engine code AVH; AZG:

    - See item 7 .
15. **30 Nm**
16. **Connection tube**
17. **Connecting piece, 35 Nm**
18. **Heat shield**
19. **Seal**
    - replace
20. **Combination valve**

- Checking. See **COMBINATION VALVE, CHECKING** .

  Vehicles with engine code AEG as of 06.99:

- without vacuum connection to Secondary Air Injection (AIR) solenoid valve -N112-

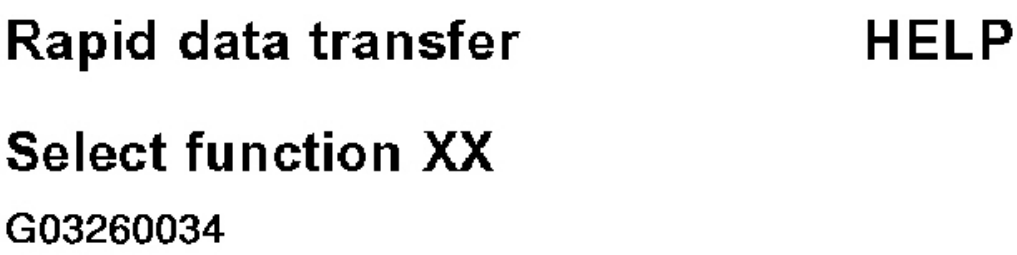

Fig. 8: Identifying Parts Of Secondary Air Injection System (Vehicles With Engine Code AEG, AVH, AZG)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Parts of Secondary Air Injection (AIR) system, removing and installing (Vehicles with engine code BDC)

NOTE: Components marked with * are tested via On Board Diagnostic (OBD). See DIAGNOSTIC MODE 3: CHECK DTC MEMORY .

NOTE: The following list refers to Fig. 9 .

1. **Combination valve**
   - Checking. See **COMBINATION VALVE, CHECKING** .
   - To replace, remove warm air collector plate
2. **O-ring**
   - Replace if damaged
3. **Pressure hose**
   - Check for secure fitting
   - to disengage, squeeze together at front
4. **Intake hose**
   - Check for secure fitting
   - To disengage, squeeze together at front
5. **To upper part of air filter**

- See item 3 in **AIR FILTER, DISASSEMBLING AND ASSEMBLING (VEHICLES WITH ENGINE CODE BDC)** .

6. **Secondary Air Injection (AIR) Pump Motor -V101-***
   - Checking. See **SECONDARY AIR INJECTION (AIR) PUMP MOTOR, CHECKING** .
   - Activation via Secondary Air Injection (AIR) Pump Relay -J299-*. See **Secondary Air Injection (AIR) pump relay -J299-* (arrow)** .
7. **Connector**
   - 2-pin
   - For Secondary Air Injection (AIR) pump motor
8. **10 Nm**
9. **25 Nm**
10. **15 Nm**
11. **Bracket**
    - For Secondary Air Injection (AIR) pump motor
    - secured to lower part of intake manifold at bottom
12. **Lower part of intake manifold**
13. **10 Nm**
14. **to connecting piece at exhaust manifold**
    - See item 7 .
15. **30 Nm**
16. **Connection tube**
17. **Connecting piece, 35 Nm**
18. **Warm air collector plate**
    - With intake manifold support
    - With mount for combination valve
19. **Seal**
    - replace

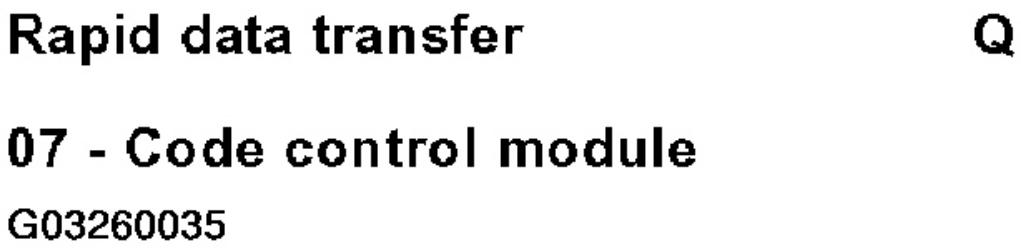

Fig. 9: Identifying Parts Of Secondary Air Injection System (Vehicles With Engine Code BDC)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Secondary Air Injection (AIR) pump relay -J299-* (arrow)

In protective housing for relays in engine compartment (inserted in wiring beside master brake cylinder).

NOTE:

- **Remove battery Ground (GND) strap if tools are necessary for removal of relays or control modules from the relay carrier.**
- **Obtain radio code for radios with anti-theft coding before disconnecting battery.**
- **Checking relay activation:**

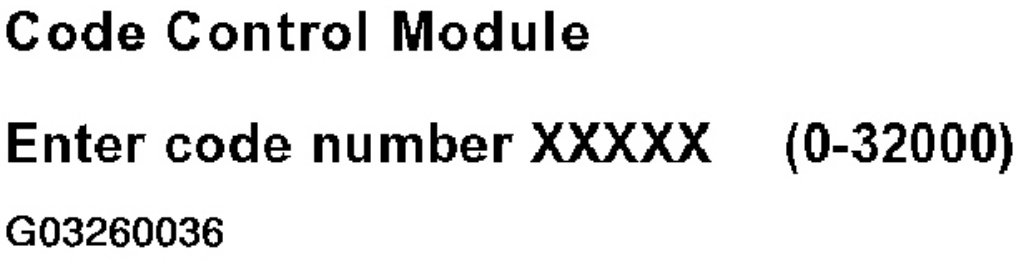

Fig. 10: Identifying Secondary Air Injection (Air) Pump Relay -J299-
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Secondary Air Injection (AIR) system, checking for proper seal

Function test

- Select the measuring value "Test-ID 03: Secondary Air Injection (AIR) system" and check whether the specified values are being reached. See **DIAGNOSTIC MODE 6: CHECK TEST RESULTS OF COMPONENTS THAT ARE NOT CONTINUOUSLY MONITORED** .
- End diagnosis and switch ignition off.

If the specified values are not reached:

Checking Proper Seal

- Check the connection pipes and hoses between Secondary Air Injection (AIR) pump motor and combination valve for proper seal.

  Secondary Air Injection (AIR) system components, removing and installing:

  - Vehicles with engine code AEG, AVH, AZG. See **PARTS OF SECONDARY AIR INJECTION (AIR) SYSTEM, REMOVING AND INSTALLING (VEHICLES WITH ENGINE CODE AEG, AVH, AZG)** .
  - Vehicles with engine code BDC. See **PARTS OF SECONDARY AIR INJECTION (AIR) SYSTEM, REMOVING AND INSTALLING (VEHICLES WITH ENGINE CODE BDC)** .
- Repeat function test.
- Check hoses and hose connections for secure seating.
- Repeat function test.

If malfunction is no longer present:

- Erase DTC memory of Engine Control Module (ECM). See **DIAGNOSTIC MODE 6: CHECK TEST RESULTS OF COMPONENTS THAT ARE NOT CONTINUOUSLY MONITORED** .
- Generate readiness code. See **READINESS CODE, GENERATING** .

Secondary Air Injection (AIR) Solenoid Valve (Vehicles with engine code AEG up to 05.99), checking

Solenoid valve is closed when no voltage is present.

Recommended special tools and equipment

- VAG1526 multimeter or VAG1715 multimeter
- VAG1594 connector test kit
- Wiring diagram

Test requirements

- Main fuses must be OK.

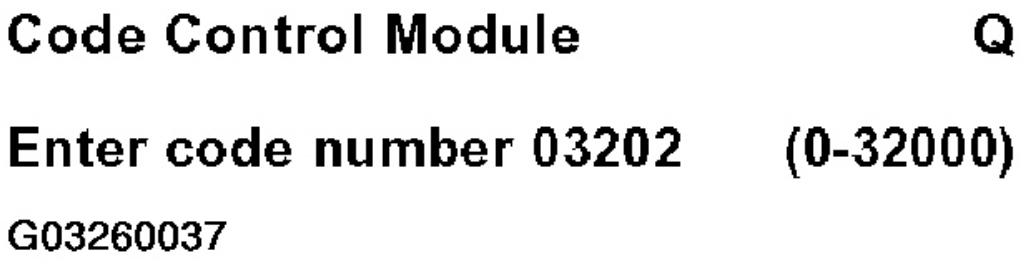

Fig. 11: Identifying Main Fuses (Secondary Air Injection Solenoid Valve: Engine Code AEG Up To 05.99)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Ignition switched off.

Test sequence

- Disconnect 2-pin connector from Secondary Air Injection (AIR) Solenoid Valve -N112- (arrow).

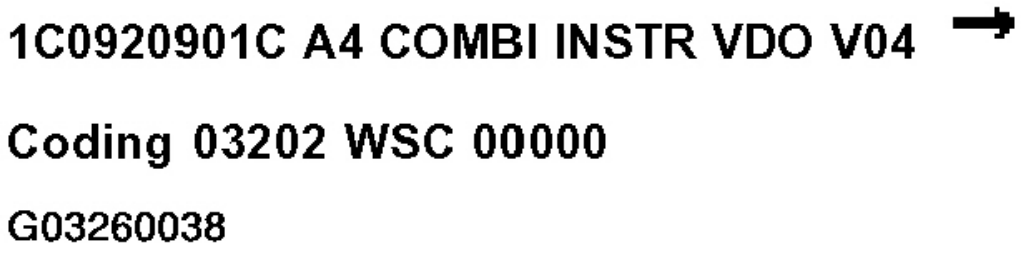

Fig. 12: Disconnecting 2-Pin Connector From Secondary Air Injection Solenoid Valve -N112- (Engine Code AEG: Up To 05.99)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Measure resistance between terminals of solenoid valve.

  Specified value: 25,0...35,0 ohm

Fig. 13: Measuring Resistance Between Terminals Of Secondary Air Injection Solenoid Valve (Engine Code AEG: Up To 05.99)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

If specified value is not obtained:

- Replace Secondary Air Injection (AIR) Solenoid Valve -N112-. See item 2 .
- Erase DTC memory of Engine Control Module (ECM). See **DIAGNOSTIC MODE 4: RESET/ERASE DIAGNOSTIC DATA** .
- Generate readiness code. See **READINESS CODE, GENERATING** .

If specified value is obtained:

- Connect test box to control module wiring harness. See **TEST BOX FOR WIRING TEST, CONNECTING** .
- Check wire between test box socket 33 + 2-pin connector terminal 2 for open circuit according to wiring diagram. Wire resistance: max. 1.5 ohm

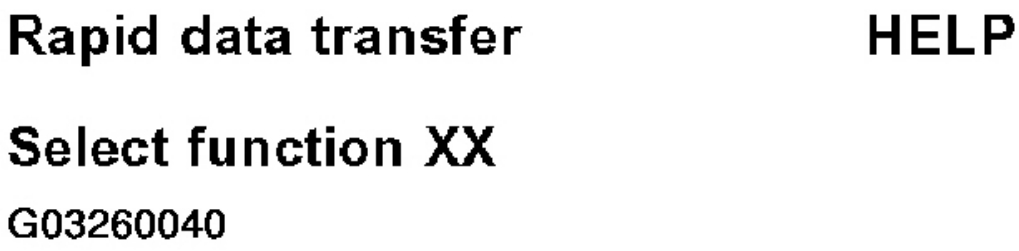

Fig. 14: Identifying Secondary Air Injection Solenoid Valve 2-Pin Harness Connector Terminals (Engine Code AEG: Up To 05.99)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Also check the wire for short circuit to B+ and Ground (GND).

Specified value: INFINITY ohm

- Check wire between 2-pin connector terminal 1 and the Fuel Pump (FP) Relay -J17- for open circuit according to wiring diagram. Wire resistance: max. 1.5 ohm

  If no malfunctions are found in wires:

- Replace Motronic Engine Control Module (ECM) -J220-. See **REPLACING ENGINE CONTROL MODULE (ECM)** .

Secondary Air Injection (AIR) pump motor, checking

Recommended special tools and equipment

- VAG1526 multimeter or VAG1715 multimeter
- VAG1594 connector test kit
- Wiring diagram

Test requirements

- Main fuses must be OK.

Fig. 15: Identifying Main Fuses (Secondary Air Injection Pump Motor)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Fuel Pump (FP) Relay -J17- must be OK.
- Secondary Air Injection (AIR) Pump Relay -J299- must be OK.
- Battery voltage must be at least 11.5 volts.
- All electrical consumers such as, for example, lights and rear window defroster must be switched off.

- Ignition switched off.

Test sequence

- Remove front noise insulation.
- Disconnect 2-pin connector from motor for secondary air pump (arrow).

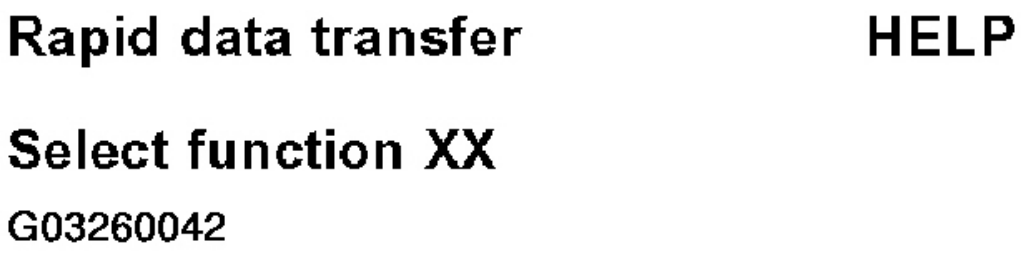

Fig. 16: Disconnecting 2-Pin Connector From Motor For Secondary Air Pump
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Disconnect pressure hose at Secondary Air Injection (AIR) pump motor (arrow).

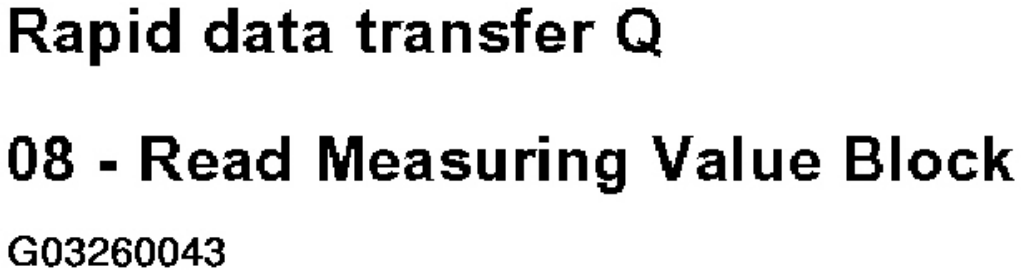

Fig. 17: Disconnecting Pressure Hose At Secondary Air Injection Pump Motor
Courtesy of VOLKSWAGEN OF AMERICA, INC.

NOTE: To disengage, compress the buttons at the hose coupling.

- Connect Secondary Air Injection (AIR) Pump Motor to the B+ and Ground (GND) terminals of the

battery using the respective adapter cables.

The Secondary Air Injection (AIR) Pump Motor must start up and air must escape at compressed-air connection (arrow).

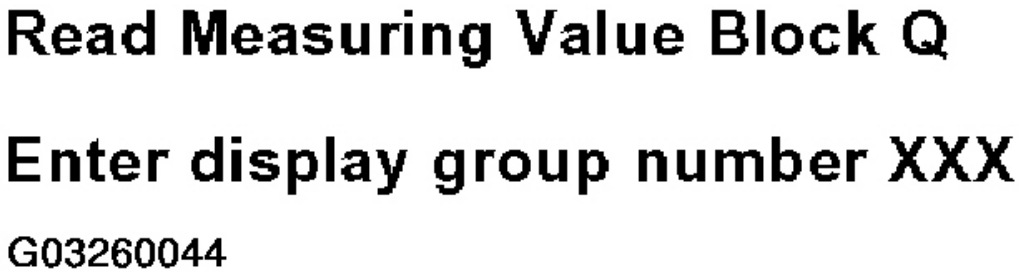

Fig. 18: Connecting Secondary Air Injection Pump Motor To B+ And Ground Terminals Of Battery
Courtesy of VOLKSWAGEN OF AMERICA, INC.

If the motor does not start up, or no air or only very little air escapes:

- Disconnect connection between Secondary Air Injection (AIR) Pump Motor and battery.
- Replace Secondary Air Injection (AIR) Pump Motor -V101-:
  - Vehicles with engine code AEG, AVH, AZG. See item 8 .
  - Vehicles with engine code BDC. See item 6 .
- Erase DTC memory of Engine Control Module (ECM). See **DIAGNOSTIC MODE 4: RESET/ERASE DIAGNOSTIC DATA** .
- Generate readiness code. See **READINESS CODE, GENERATING** .

If motor starts, and air escapes:

- Disconnect connection between Secondary Air Injection (AIR) Pump Motor and battery.
- Remove Secondary Air Injection (AIR) pump relay from relay carrier in protective housing for control modules:
- Vehicles with engine code AEG, AVH, AZG. See item 4 .
- Vehicles with engine code BDC. See **Secondary Air Injection (AIR) pump relay -J299-* (arrow)** .

NOTE:

- **Remove battery Ground (GND) strap if tools are necessary for removal of**

relays or control modules from the relay carrier.

- **Obtain radio code for radios with anti-theft coding before disconnecting battery.**

Continuation for all vehicles

- Check wire between terminal 2 of relay carrier and terminal 2 of 2-pin connector of Secondary Air Injection (AIR) Pump Motor for open circuit according to wiring diagram. Wire resistance: max. 1.5 ohm

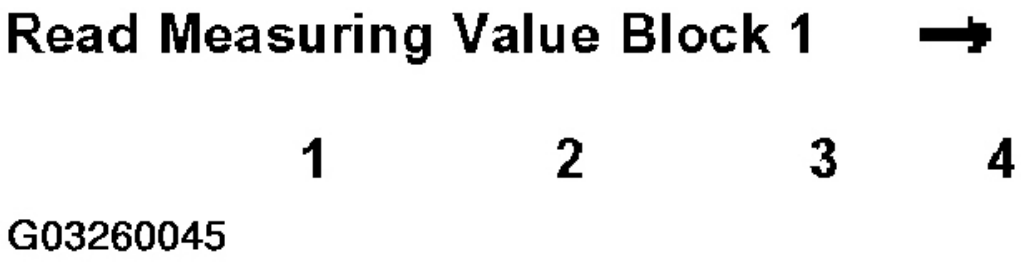

Fig. 19: Identifying Secondary Air Injection Pump Motor Wiring Harness Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Also check the wire for short circuit to B+ and Ground (GND). Specified value: INFINITY ohm
- Check wire between 2-pin connector terminal 1 and Ground (GND) for open circuit according to wiring diagram. Wire resistance: max. 1.5 ohm

If no malfunctions are found in wires:

- Replace Motronic Engine Control Module (ECM) -J220-. See **REPLACING ENGINE CONTROL MODULE (ECM)** .

Combination valve, checking

Vehicles with engine code AEG up to 05.99:

Vehicles with engine code AEG as of 06.99, AVH, AZG, BDC. See **Vehicles with engine code AEG as of 06.99, AVH, AZG, BDC** .

Recommended special tools and equipment

- VAG1390 Hand Vacuum Pump

Test requirements

- No leaks in vacuum lines or hose connections.
- Vacuum hoses not clogged or kinked
- Pressure hose for Secondary Air Injection (AIR) Pump Motor not clogged or kinked

Test sequence

NOTE: Do not use pressurized air for the following test!

- Remove front noise insulation.
- Disconnect vacuum hose -1- from combination valve at Secondary Air Injection (AIR) solenoid valve (N112) -2-. See **Fig. 20** .

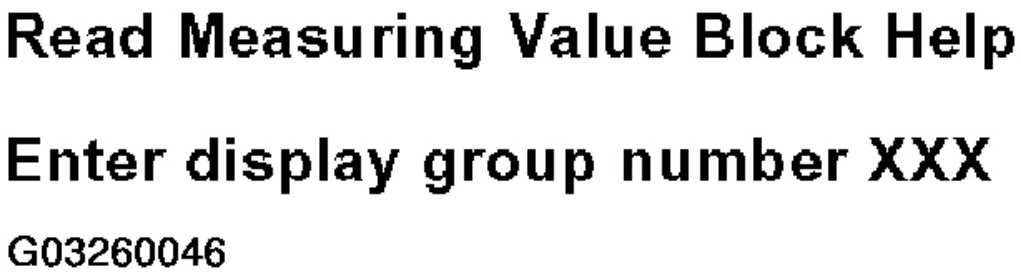

Fig. 20: Testing Combination Valve At Secondary Air Injection Solenoid Valve (Engine Code AEG: Up To 05.99)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Connect hand vacuum pump (VAG1390) at vacuum hose -1- to combination valve.
- Disconnect pressure hose at Secondary Air Injection (AIR) pump motor (arrow) and blow into it with light pressure. Combination valve must close.

NOTE: To disengage, compress the buttons at the hose coupling.

- Operate vacuum pump. Combination valve must open.

If the combination valve does not open or it is constantly open:

- Replace combination valve. See item 20 .
- Erase DTC memory of Engine Control Module (ECM). See **DIAGNOSTIC MODE 4: RESET/ERASE DIAGNOSTIC DATA** .
- Generate readiness code. See **READINESS CODE, GENERATING** .

Vehicles with engine code AEG as of 06.99, AVH, AZG, BDC

Test requirements

- Pressure hose for Secondary Air Injection (AIR) Pump Motor not clogged or kinked
- Hose connections must be properly sealed.

Test sequence

NOTE: Do not use pressurized air for the following test!

- Remove front noise insulation.
- Disconnect pressure hose (arrow) from Secondary Air Injection (AIR) pump motor.

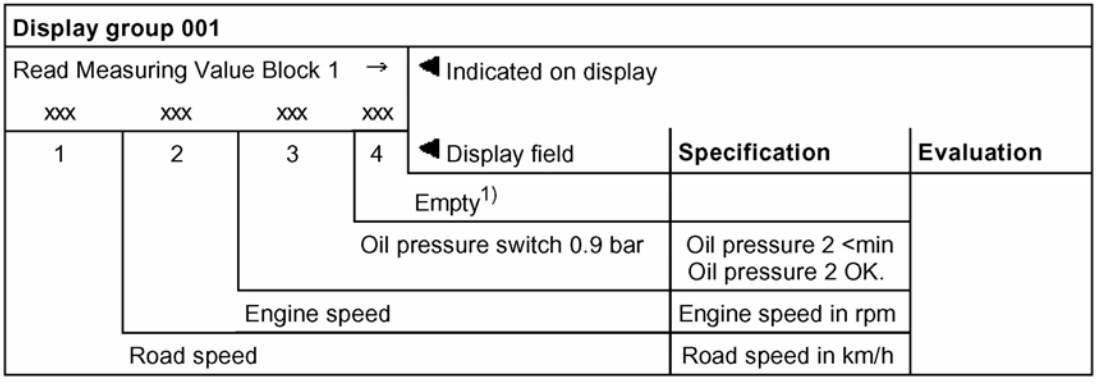

Fig. 21: Disconnecting Pressure Hose From Secondary Air Injection Pump Motor (Engine Code AEG From 06.99, And Engine Codes AVH, AZG, BDC)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

NOTE: To disengage, compress the buttons at the hose coupling.

- Blow with light pressure into pressure hose to combination valve. Combination valve must close.
- Blow with high pressure into pressure hose to combination valve. Combination valve must open.

If the combination valve does not open or it is constantly open:

- Replace the combination valve:
  - Vehicles with engine code AEG, AVH, AZG. See item 20 .
  - Vehicles with engine code BDC. See item 1 .
- Erase DTC memory of Engine Control Module (ECM). See **DIAGNOSTIC MODE 4: RESET/ERASE DIAGNOSTIC DATA** .

- Generate readiness code. See **READINESS CODE, GENERATING** .

TURBOCHARGER, G-CHARGER

CHARGE AIR PRESSURE WITH TURBOCHARGER

Turbocharger system components, removing and installing

Observe rules for cleanliness. See **RULES FOR CLEANLINESS** .

NOTE:

- **All hose connections are secured with clips.**
- **Charge air pressure must be leak free.**
- **Replace self-locking nuts.**

NOTE: The following list refers to items in Fig. 1 .

1. **Exhaust manifold**
   - With turbocharger
   - Only replace as assembly
2. **Intake manifold**
3. **from charge air cooler**
4. **Gasket**
   - Replace
   - Coating (beading) toward intake manifold
5. **25 N.m (18 ft lb)**
6. **Gasket**
   - Note installation position
7. **Bracket**
   - For heat shield (item -9-)
8. **Washer**
9. **Heat shield**
   - Engage in bracket (item -7-)
10. **Turbocharger**
    - Only replace as assembly
    - Removing: remove right drive shaft at transmission:

      See **FRONT AXLE SHAFT** .

- Charge air pressure control, checking. See **CHARGE AIR PRESSURE SYSTEM, CHECKING** .

11. **Pressure unit**
    - For charge air pressure control valve
    - Integral part of turbocharger; cannot be replaced
12. **From Air Cleaner**
13. **Gasket**
    - Replace
14. **Sealing ring**
    - Replace
15. **Oil return pipe**
    - To cylinder block
16. **Banjo bolt**
    - 25 N.m (18 ft lb)
17. **15 N.m (11 ft lb)**
18. **40 N.m (30 ft lb)**
19. **Bracket**
20. **25 N.m (18 ft lb)**
21. **Gasket**
    - Replace
22. **Front exhaust pipe**
23. **Connection**
24. **10 N.m (7 ft lb)**
25. **Oil supply pipe**

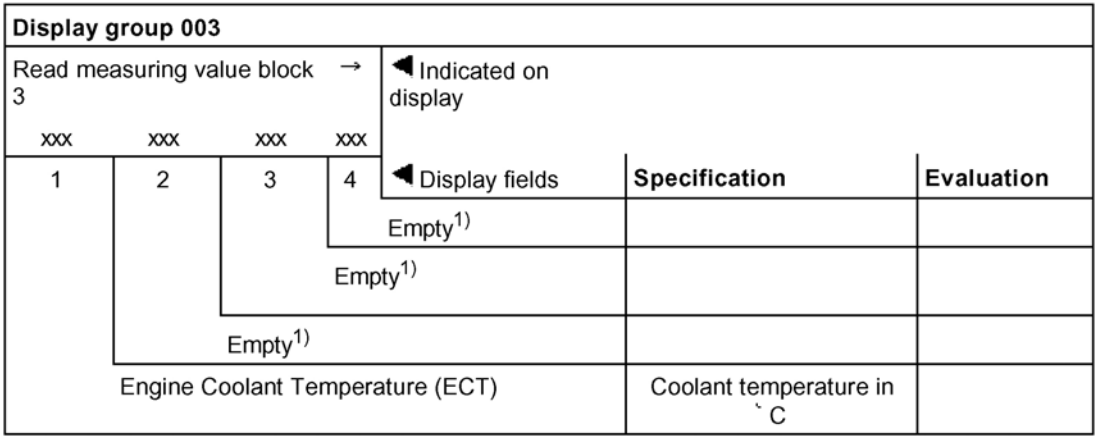

Fig. 1: Exploded View Of Turbocharger System Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Charge air cooler components, removing and installing

NOTE:

- **All hose connections are secured by clips.**
- **Charge air pressure must be free of leaks.**

NOTE: The following list refers to items in Fig. 2 .

1. **Charge air cooler**
2. **10 N.m (7 ft lb)**
3. **Connecting hose**
4. **Connecting pipe**
   - Charge air cooler/intake manifold
   - Lower pipe
5. **Connecting hose**
6. **Connecting pipe**
   - Charge air cooler/intake manifold
   - Upper pipe
7. **O-ring**
   - Replace if damaged
8. **Intake Air Temperature sensor -G72-**
9. **5 N.m (3.7 ft lb)**
10. **Connecting hose**

- Charge air cooler/intake manifold

11. **Connecting hose**
    - Charge air cooler/turbocharger
12. **Charge air cooler**
13. **Bracket**

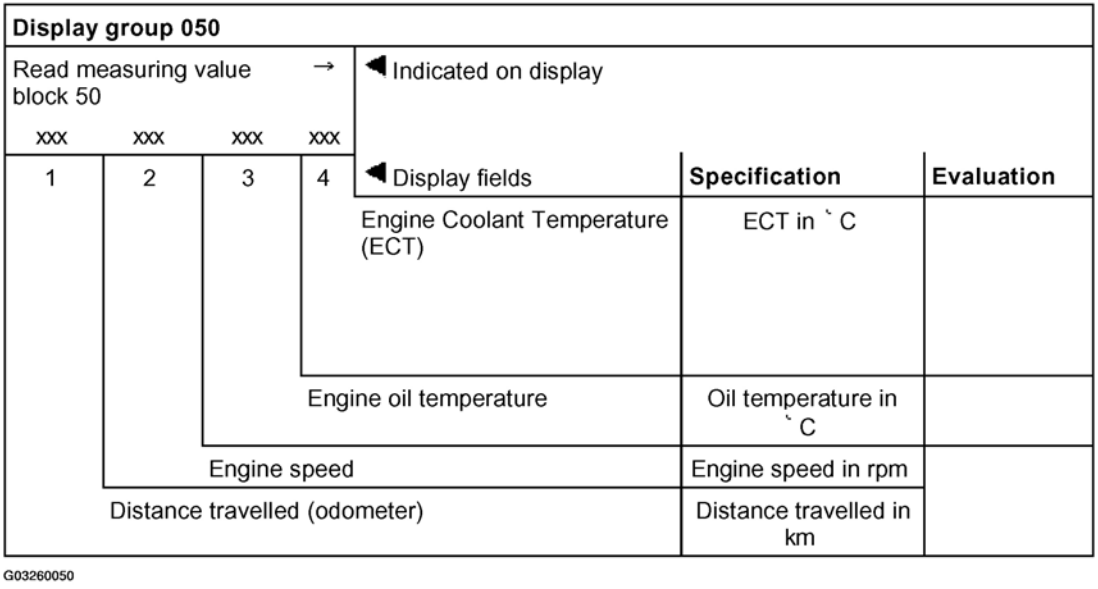

Fig. 2: Exploded View Of Charge Air Cooler Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Turbocharger, hose and pipe connections

Vacuum hose diagram

NOTE: The following list refers to items in Fig. 3 .

1. Solenoid valve for Wastegate Bypass regulator valve -N75-
2. to EGR vacuum regulator solenoid valve -N18-
3. to air filter
4. Vacuum reservoir
5. Reservoir for wastegate
6. Turbocharger
7. to Intake Manifold Change-over valve -N239-
8. Return valve, with connection points to Wastegate Bypass regulator valve -N75-.

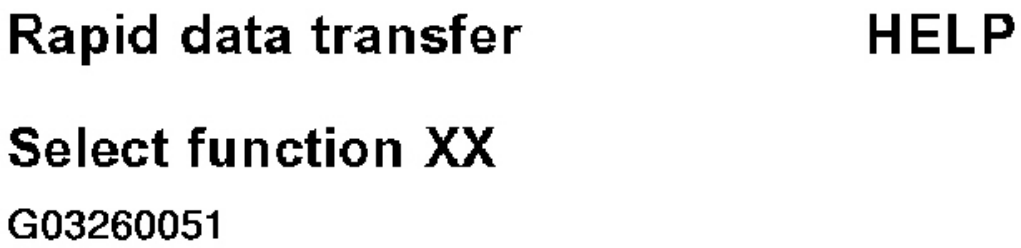

Fig. 3: Exploded View Of Turbocharger, Hose And Pipe Connections
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Rules for cleanliness

When working on the turbocharger and charge air pressure, pay careful attention to the following rules:

- Thoroughly clean all unions and the adjacent areas before disconnecting.
- Place parts that have been removed on a clean surface and cover over. Do not use fluffy cloths!
- Carefully cover opened components or seal, if the repair cannot be carried out immediately.
- Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored loose (e.g. in tool boxes etc.).
- When the system is open: Do not work with compressed air if it can be avoided. Do not move vehicle unless absolutely necessary.

CHARGE AIR PRESSURE SYSTEM, CHECKING

Special tools and equipment

- VAG 1390 Vacuum pump
- Fluke 83 Multimeter
- VW 1594 Adaptor kit
- VAG 1598/22 Test box
- VAG 1551/1552 with VAG 1551/3 adaptor cable
- Wiring diagram

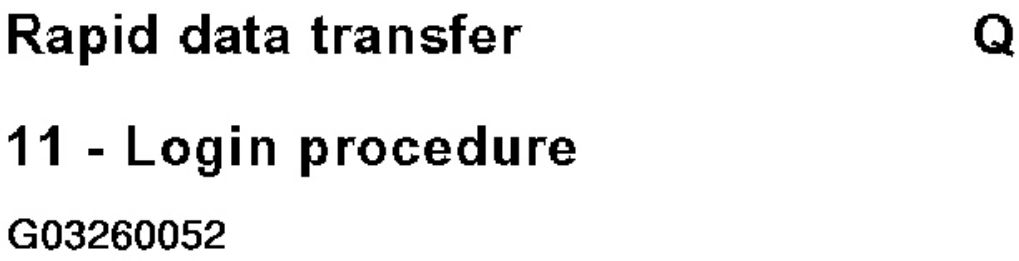

Fig. 4: Identifying Special Tools And Equipment
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Checking conditions

- No DTCs stored in Diagnostic Trouble Code memory

  See DTC Memory, Checking .

- No leaks from intake and exhaust systems.
- No stored DTCs from engine and fuel injection system, e.g. start of injection, fuel injectors and compression pressure.
- Engine oil temperature 80°C minimum.

Test sequence

Observe following if test and measuring instruments are required during a test drive:

- Test and measuring instruments must be secured to the rear seat and operated by a 2nd person from this location.

  CAUTION: If test and measuring instruments are operated from the front passenger seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat could receive serious injuries when the airbag is triggered.

- Connect VAG 1551/1552 Scan Tool

  See VAG1551/1552 Scan Tool, Connecting .

- Start engine and let idle
- Press 0 and 1 buttons to select Address word 01 "Engine electronics"

Display will appear as shown in **Fig. 5** .

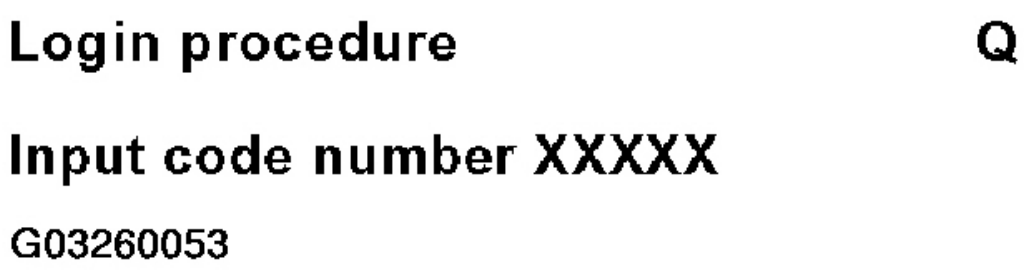

Fig. 5: Identifying VAG 1551/1552 Scan Tool Display (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press 0 and 8 buttons to select Function 08: "Read measuring value block"
- Press Q button to enter input

Display will appear as shown in **Fig. 6** .

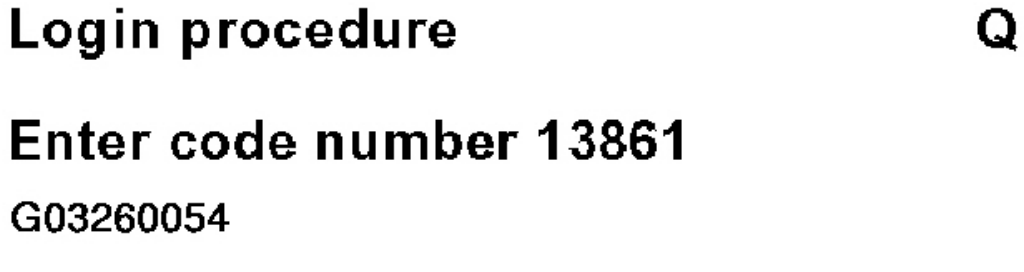

Fig. 6: Identifying VAG 1551/1552 Scan Tool Display (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press 0, 1 and 1 buttons to select Display Group 11
- Press Q button to enter input

  Read measuring value block 11 --> 840 RPM 938 mbar 978 mbar 92 %

Display will appear as shown

- Accelerate vehicle in 3rd gear from about 1500 RPM under Wide Open Throttle.
- Press VAG 1551 PRINT button at approx. 3000 RPM.

  Read measuring value block 11 --> 3090 RPM 1866 mbar 1917 mbar 62%

  Specification: 1700 to 2200 mbar (in display zone 3)

If specification not obtained:

- Perform Output Diagnostic Test Mode to activate Wastegate Bypass Regulator valve:

  See Function 03: Output Diagnostic Test Mode, Performing .

Display will appear as shown in **Fig. 7** .

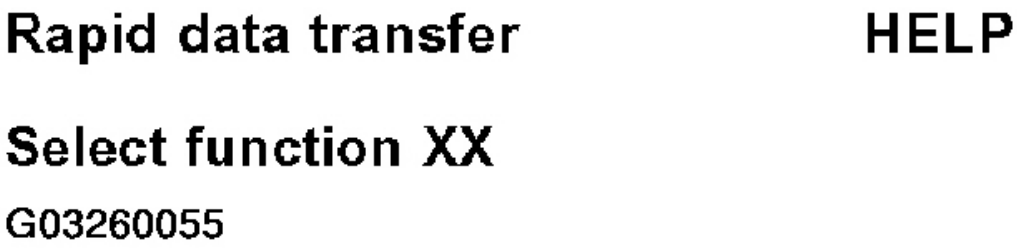

Fig. 7: Identifying VAG 1551/1552 Scan Tool Display (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

NOTE: The valve must function and the charge air pressure control rod must move back and forth (at least 3 to 4 times), as long as there is a vacuum in the vacuum reservoir.

If rod moves but pressure specifications are not obtained

- Replace turbocharger.

If rod does not move because solenoid valve is not working:

- Check Wastegate Bypass Regulator valve -N75-. See **WASTEGATE BYPASS REGULATOR VALVE -N75-, CHECKING** .
- Check vacuum hoses. See **TURBOCHARGER, HOSE AND PIPE CONNECTIONS** .

If rod does not move but solenoid operates:

- Connect VAG 1390 vacuum pump to Wastegate Bypass Regulator valve and check rod for ease of movement.

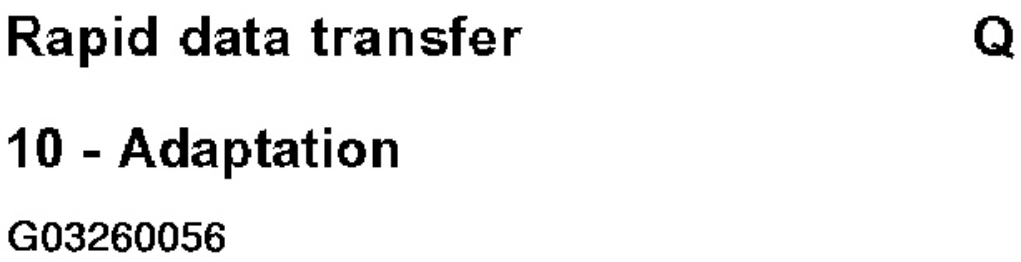

Fig. 8: Connecting Turbocharger To VAG 1390 Vacuum Pump
Courtesy of VOLKSWAGEN OF AMERICA, INC.

If rod does not move easily:

- Replace turbocharger assembly.

Wastegate Bypass Regulator valve -N75-, checking

- Switch ignition off.
- Disconnect Wastegate Bypass Regulator valve.
- Measure resistance between valve terminals.

Engine code ALH

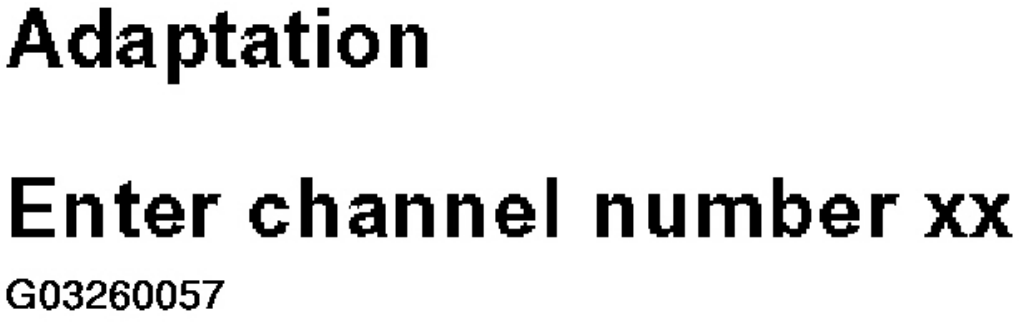

Fig. 9: Measuring Resistance Between Wastegate Bypass Regulator Valve Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Specification: 14 to 20 ohms

If specification not obtained:

- Replace Wastegate Bypass Regulator valve -N75-.

If specification obtained:

- Switch ignition on.
- Measure supply voltage at valve connector terminal 1 and at engine Ground.

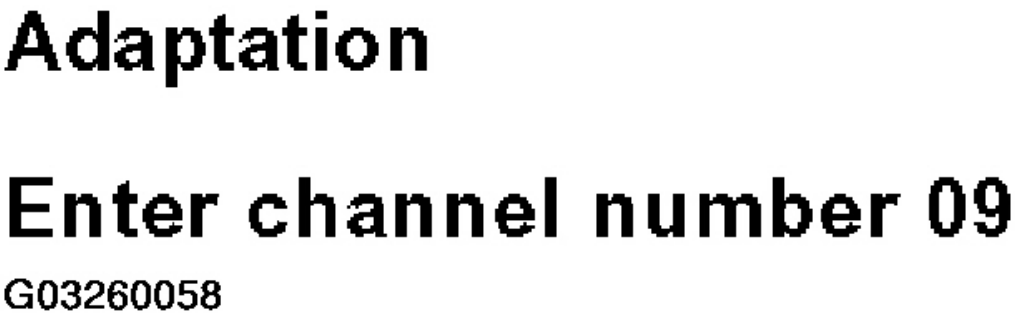

Fig. 10: Measuring Supply Voltage At Wastegate Bypass Regulator Valve Connector Terminal

Courtesy of VOLKSWAGEN OF AMERICA, INC.

Specification: approx. battery voltage

If specification not obtained:

- Switch ignition off.
- Connect test box VAG 1598/22 to ECM wiring harness.

Fig. 11: Connecting Test Box VAG 1598/22 To ECM Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring for open circuit between Test Box and harness connector using Wiring diagram.

Up to MY 1999

- Terminal 1 + sockets 2 + 28
- Terminal 2 + socket 15

From MY 2000

- Terminal 1 + sockets 1 + 2
- Terminal 2 + socket 62

Wire resistance: 1.5 ohms maximum

- Check wires for short to one another, to vehicle Ground and to battery Plus.

  Specification: "INFINITE"ohms

If wiring OK

- Replace Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) -J248-:

  See Engine Control Module (ECM), Replacing .

EXHAUST SYSTEM, EMISSION CONTROLS

EXHAUST SYSTEM COMPONENTS, REMOVING AND INSTALLING

NOTE:

- **Removing and installing exhaust manifold. See TURBOCHARGER SYSTEM COMPONENTS, REMOVING AND INSTALLING .**
- **After working on the exhaust system make sure that the system is not under stress, and that it has sufficient clearance from the bodywork. If necessary, loosen double and single clamps and align muffler and exhaust pipe so that sufficient clearance is maintained to the bodywork and the support rings are evenly loaded.**
- **Replace self-locking nuts.**

Front exhaust pipe and catalyst with attachments

NOTE: The following list refers to items in Fig. 12 .

1. **from turbocharger**
2. **Gasket**
   - Replace
3. **25 N.m (18 ft lb)**
4. **Catalyst**
5. **to central muffler**
6. **Mounting**
7. **25 N.m (18 ft lb)**

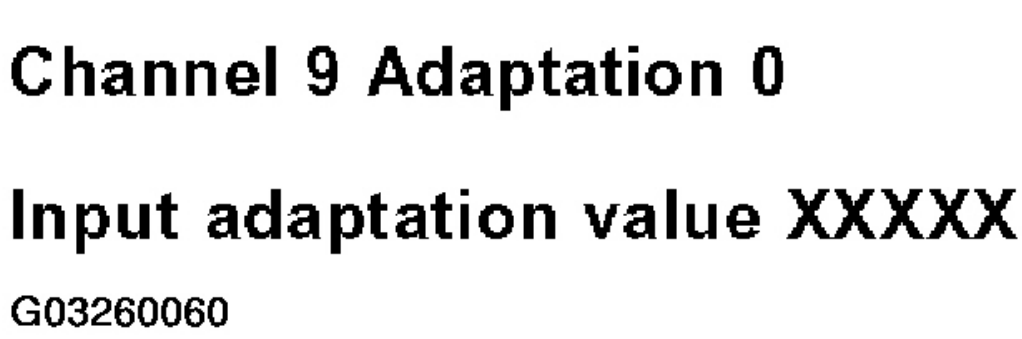

Fig. 12: Identifying Front Exhaust Pipe And Catalyst With Attachments
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Muffler with mountings

NOTE: The following list refers to items in Fig. 13 .

1. **40 N.m (30 ft lb)**
2. **from catalyst**
3. **Double clamp**
   - Note installation position. See **Double clamp installed position, checking**
4. **25 N.m (18 ft lb)**
5. **Mounting**
   - Note installation position. See **Installation position of mounting**
6. **Mounting**
   - With retaining ring
7. **Bracket**
8. **Mounting**
9. **Rear muffler**
   - Align rear muffler stress free. See **Rear muffler, aligning free of stress** .
10. **Separating point**
    - For repairs
    - Marked by three impressions on circumference of exhaust pipe
    - In production, exhaust pipe and rear mufflers are installed as a single component. For repairs, the exhaust pipe and rear muffler are supplied individually with a double clamp to allow connecting together.
    - Cut through connecting pipe at right angle to separation point. See **Exhaust pipe, separation**

point .

11. **20 N.m (15 ft lb)**
12. **Tunnel bridge**

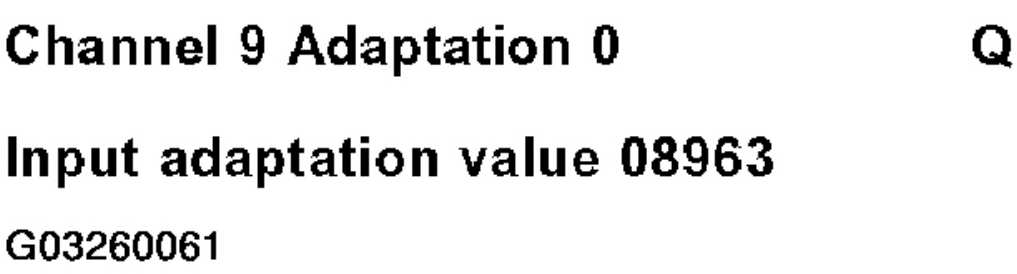

Fig. 13: Identifying Muffler With Mountings
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Double clamp installed position, checking

Fig. 14: Identifying Double Clamp Installed Position
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Position double clamp approx. 5 mm from mark A (arrow -1-).

NOTE: Mark -A- is valid for vehicles with either manual or automatic transmissions.

Installation position of mounting

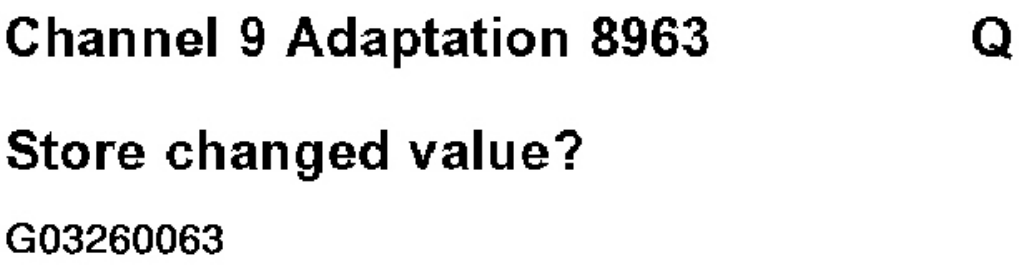

Fig. 15: Identifying Installation Position Of Mounting
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Angled side on foot of mounting (arrow) points forward.

Exhaust pipe, separation point

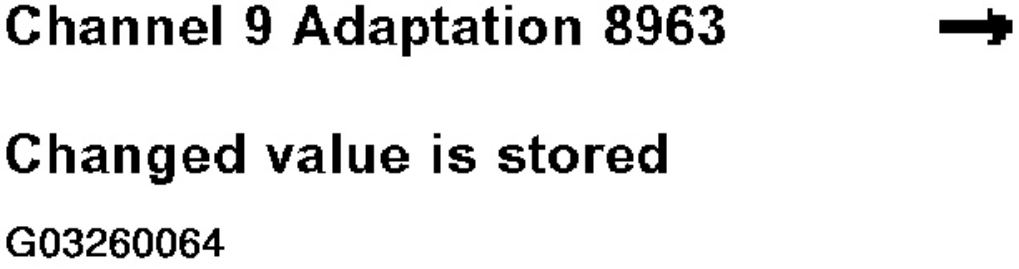

Fig. 16: Identifying Exhaust Pipe, Separation Point
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Cut exhaust pipe at right angles to separating point (arrow -2-).
- Position repair clamp -4- when installing (arrows -1- and -3-)
  - Tightening torque 40 N.m (30 ft lb)

Rear muffler, aligning free of stress

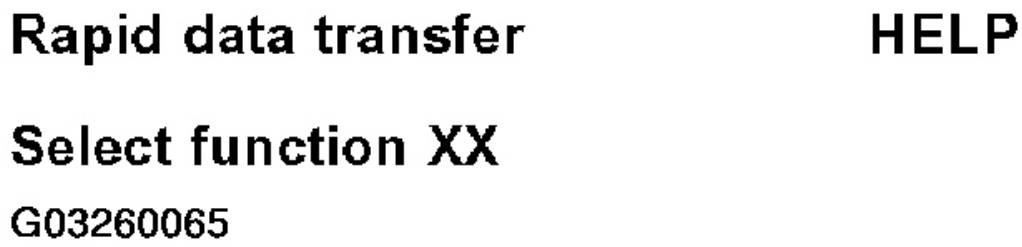

Fig. 17: Rear Muffler, Aligning Free Stress
Courtesy of VOLKSWAGEN OF AMERICA, INC.

NOTE: Mounting pins on exhaust pipe must run parallel with tunnel bridge (dimension -x- on left and right = the same).

EXHAUST GAS RECIRCULATION (EGR) SYSTEM, OVERVIEW

NOTE:

- **The function/control of the Exhaust Gas Recirculation (EGR) system is managed by the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) -J248- via the EGR Vacuum Regulator solenoid valve -N18-.**
- **The cone shaped plunger in the mechanical EGR valve ensures that various cross sectional openings are possible at different plunger heights.**
- **Every possible valve position is provided via pulsed control.**
- **Replace self-locking nuts.**

Exhaust Gas Recirculation (EGR) system components, removing and installing

NOTE: The following list refers to items in Fig. 18 .

1. **Intake manifold**
2. **O-ring**
   - Replace
3. **Throttle valve**
   - With EGR valve and control flap
4. **Exhaust Gas Recirculation (EGR) valve**
   - Component of intake support
   - Can only be replaced with intake support assembly
   - Checking: See **EXHAUST GAS RECIRCULATION (EGR) VALVE, CHECKING** .

- Control, checking:

See Function 03: Output Diagnostic Test Mode, Performing .

5. **10 N.m (7 ft lb)**
6. **from Air Cleaner**
7. **Gasket**
   - Replace
8. **25 N.m (18 ft lb)**
9. **Connecting pipe**
   - EGR cooler to intake support
10. **Connecting pipe**
    - EGR cooler to exhaust elbow
11. **Exhaust manifold**
12. **25 N.m (18 ft lb)**
13. **to heat exchanger**
14. **EGR cooler**
15. **Connection**
    - Heater
16. **to Coolant expansion tank**

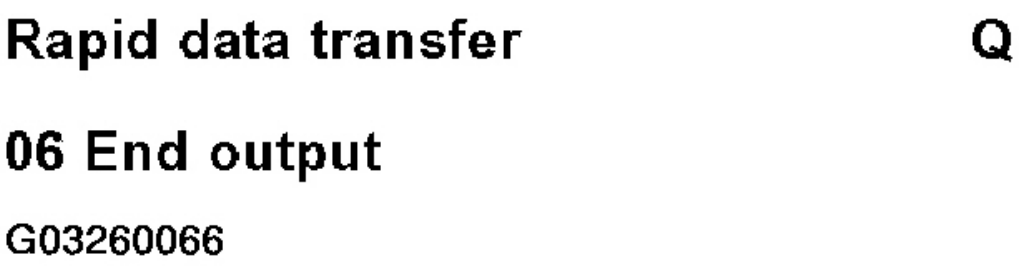

Fig. 18: Exploded View Of Exhaust Gas Recirculation (EGR) System Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Vacuum hose connections, diagram

NOTE: The following list refers to items in Fig. 19 .

1. **EGR valve**

2. **EGR Vacuum Regulator solenoid valve -N18-**
3. **Check valve**
4. **Brake servo**
5. **Air Cleaner**
6. **Vacuum pump**

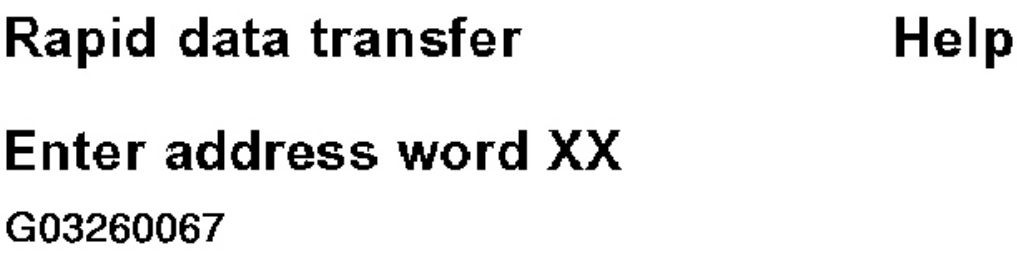

Fig. 19: Identifying Vacuum Hose Connections
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Exhaust Gas Recirculation (EGR) valve, checking

Special tools and equipment

- VAG 1390 Hand vacuum pump

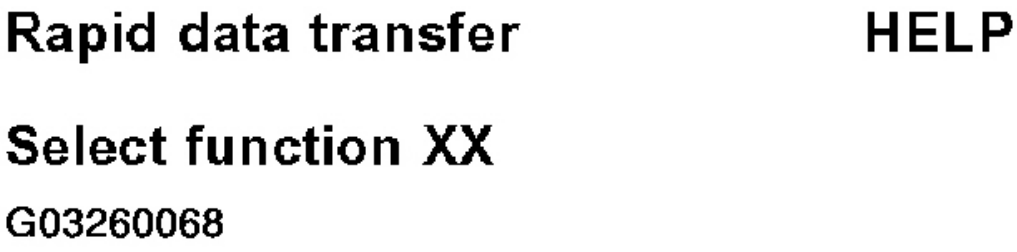

Fig. 20: Identifying VAG 1390 Hand Vacuum Pump
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test sequence

- Remove engine cover.
- Disconnect pipe between Charge Air cooler and intake manifold at intake manifold.
- Disconnect vacuum hose from EGR valve.
- Connect VAG 1390 hand vacuum pump to EGR valve.
- Operate pump and observe membrane rod.

  Membrane rod must move in direction of arrow.

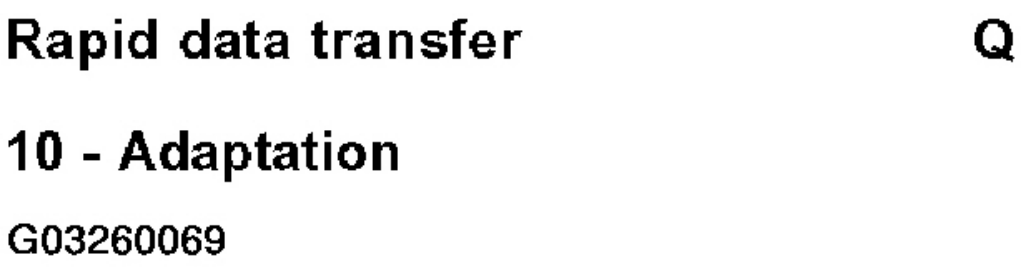

Fig. 21: Locating Hand Vacuum Pump Membrane Rod
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Disconnect hand vacuum pump hose from EGR valve.

  Membrane rod must move back against direction of arrow to its original position.

Exhaust Gas Recirculation (EGR), checking

Special tools and equipment

- Fluke 83 multimeter
- VW 1594 Adaptor kit
- VAG 1598/22 Test Box
- VAG 1551/1552 Scan Tool with VAG 1551/3 adaptor cable
- Wiring diagram

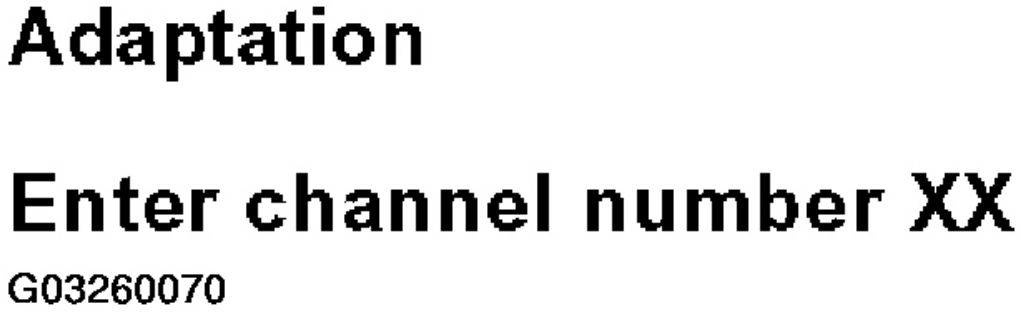

Fig. 22: Identifying Special Tools And Equipment
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test sequence

NOTE: The EGR return function is checked via Function 04 (Basic Setting). Through this procedure the valve for EGR is metered every 10 seconds, so that in measured value block 003 the extreme values for the EGR (air mass sensor) in display field 3 can be read.

- Connect VAG 1551/1552 Scan Tool:

  See VAG1551/1552 Scan Tool, Connecting .

- Start engine and let idle.
- Press 0 and 1 buttons to select Address word 01 "Engine electronics":

  See DTC Memory, Checking .

Indicated on display

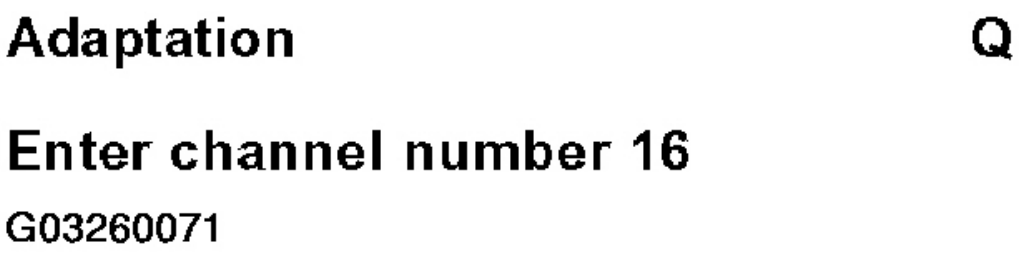

Fig. 23: Identifying Special Tools Display (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press 0 and 4 buttons to select Function 04: "Basic setting".
- Press Q button to enter input.

Indicated on display

Fig. 24: Identifying Special Tools Display (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press 0, 0 and 3 buttons to select "Display group 3".
- Press Q button to enter input.

Indicated on display: (1 to 4 - Display zones)

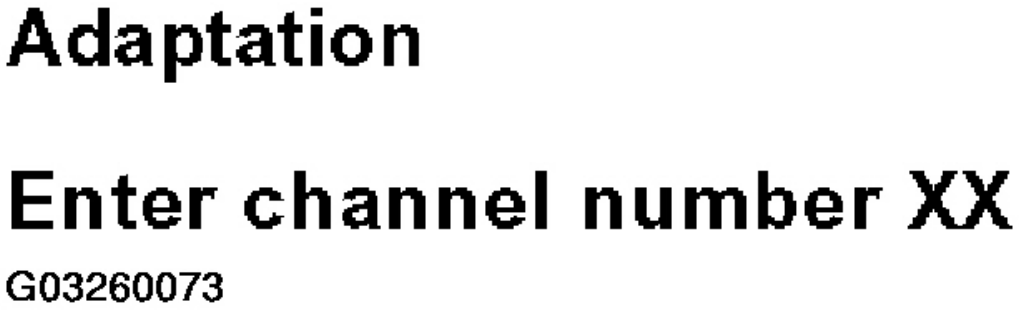

Fig. 25: Identifying Special Tools Display (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Display in field 2 must fluctuate every 10 seconds between EGR active or EGR inactive (n.aktiv).

Displays in display zones 3 and 4 must fluctuate within following control range:

NOTE: If a constant value of 550 mg/H is indicated in display zone 3, check Mass Air Flow sensor.

See Mass Air Flow (MAF) Sensor -G70-, Checking .

If EGR NOT active:

Specification display zone 3: 420 to 560 mg/stroke

Specification display zone 4: 0 to 5%

If EGR active:

Specification display zone 3: 170 to 340 mg/stroke

Specification display zone 4: 95 to 100%

If specifications not obtained:

- Check mechanical EGR valve. See **EXHAUST GAS RECIRCULATION (EGR) VALVE, CHECKING** .
- Check vacuum hoses. See **VACUUM HOSE CONNECTIONS, DIAGRAM** .
- Check EGR Vacuum Regulator solenoid valve as follows:

- Press --> button.
- Press 0 and 6 buttons to select Function 06: "End transfer"
- Press Q button to enter input.
- Switch ignition off.
- Disconnect harness connector -1- from EGR valve -2-.

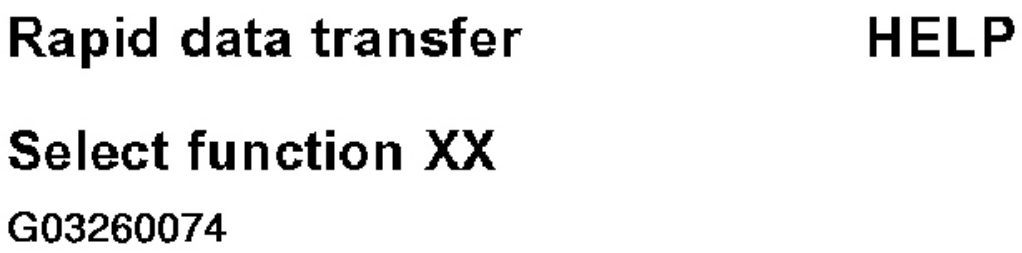

Fig. 26: Locating Harness Connector
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Measure resistance across valve.

  Specification: 14 to 20 ohms

If specification not obtained:

- Replace EGR Vacuum Regulator solenoid valve -N18-.

NOTE: At room temperature, resistance lies in the lower tolerance range and in the upper range at operating temperature.

If specification obtained:

- Switch ignition on.
- Measure supply voltage at valve connector terminal 1 and at engine Ground.

Fig. 27: Identifying EGr Vacuum Regulator Solenoid Valve Connector Terminal
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Specification: approx. battery voltage

If specification not obtained:

- Switch ignition off.
- Connect Test Box VAG 1598/22 to ECM wiring harness.

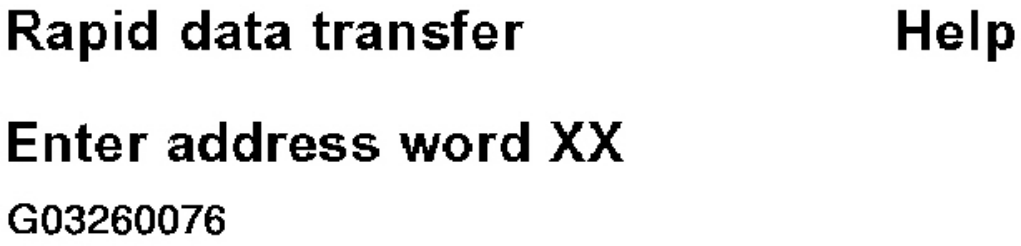

Fig. 28: Connecting Test Box VAG 1598/22 To ECM Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring for open circuit between Test Box and harness connector using wiring diagram.

Up to MY 1999

- Socket 1 + terminals 2 + 28
- Socket 2 + terminal 29

From MY 2000

- Socket 1 + terminals 1 + 2
- Socket 2 + terminal 61

Wire resistance: 1.5 ohms maximum

- Check wires for short to one another, to vehicle Ground and to battery Positive (+).

  Specification: "INFINITE" ohms

If wiring OK:

- Replace Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) -J248:

  See Engine Control Module (ECM), Replacing .